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Science-fiction 25c

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BY

ANSON MACDONALD

AUGUST
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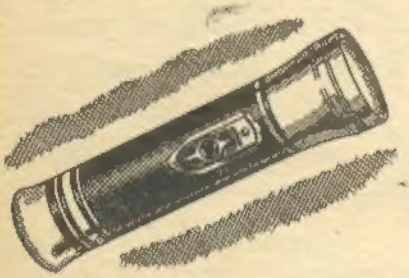
AST—1H

WHEN and HOW to Use Your FLASHLIGHT in a BLACKOUT

THESE INSTRUCTIONS Reviewed and Passed by the OFFICE OF CIVILIAN DEFENSE



1 EVERY HOME should have one or more flashlights! But before buying *new* ones, inspect and repair your *old* ones. They may need only a new bulb, new lens or fresh batteries.

2 KEEP YOUR FLASHLIGHT in a convenient, accessible place —and *always* in its place. When using it INDOORS, never point it toward unshielded windows, skylights or open doors.

3 DO NOT USE an *unshielded* flashlight OUTDOORS in a blackout except when absolutely necessary. Keep the beam level or downward—never point it even *slightly* upward. And never point it toward highly reflective surfaces.

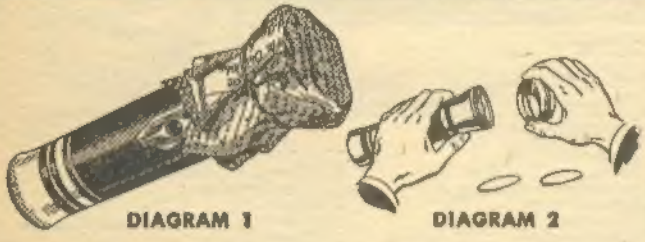


DIAGRAM 1 DIAGRAM 2

4 HERE'S HOW TO SHIELD your flashlight for outdoor use: Cover lens with two thicknesses of newspaper or similar paper, held in place by string, as in Diagram 1. OR, cut two discs of paper and insert under lens, as in Diagram 2. Deep red paper may also be used (blue is unsatisfactory). **CAUTION: The Office of Civilian Defense has not yet approved any so-called "blackout lights."** To be safe, follow the instructions given here, *until further instructions are issued.*

KEEP FLASHLIGHTS LOADED with fresh batteries, and have an extra set on hand for your light in case of long-continued use.

THE FOREGOING INSTRUCTIONS ARE PUBLISHED FOR YOUR AID AND GUIDANCE

We hope you will never meet with an emergency, but if you do, we hope you will have *fresh* "Eveready" batteries in your flashlight, because we know they will not fail you. Fresh, DATED "Eveready" batteries last longer.

FRESH BATTERIES LAST LONGER... *Look for the* **DATE-LINE**

ASTOUNDING
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LIFE AS WE KNOW IT

That familiar phrase "life as we know it" is usually used in scientific material to refer to the biological system based on carbon, oxygen and water. In the newspapers of today, it refers to the rights of the individual as opposed to a system wherein the individual is considered as unimportant as an individual ant. "Murder him if it's convenient—put him to work if you'd rather; what he wants is no matter."

Let's give it another sense—let's apply it to the technical civilization and arrangements we have here. For instance, our bridges, our automobiles, our typewriters are all designed on a basis of one Earth-gravity, and human manipulatory digits plus human senses.

Or consider Dr. E. E. Smith's Tregonsee, the Rigellian Lensman. No eyes, no ears—and no hands in our sense. An automobile would certainly not be designed as are ours if it were intended for Tregonsee's people. Glass breaks, and even modern safety glass is dangerous. Just make the whole car bullet-shaped, and sheet metal throughout. And, of course, no lighting system would be needed. Smith's Manarkans—they naturally communicate by telepathy, and have no vocal organs—would have no use for radio themselves, and would probably be rather slow developing radio-controlled apparatus in consequence.

Here's another item—the question of artificial illumination might be most unpleasantly difficult for a lot of races. But suppose we had evolved on a planet circling a Type O or B sun—a superhot supergiant sun. Our eyes would have become adapted to the light of that star—the furious violet-blue light of a star radiating at a temperature of somewhere between thirty thousand and fifty thousand degrees Absolute. The main energy radiation of such a star is far, far out in the extreme ultraviolet. The most brilliant part of the light would be hard ultraviolet, the "near ultraviolet," invisible to our eyes, would be less intense, the violet, blue and green still weaker—in comparison.

Had we evolved there, on such a planet, it's a fair bet we'd have eyes adjusted to see that ultraviolet-violet light as white; to such eyes, old Sol's light would be a dull and angry red glow.

And would technical science be up against a honey of a headache there!

Wanted: an artificial-light source very rich in the ultraviolet-violet spectrum. Available: practically nothing that's feasible. A candle flame wouldn't be worth a hoot to men of such a world—it would all be "invisible heat" to them. Anything farther down the scale than the green would be pretty feeble, and as unpleasant to their eyes as trying to work by the light of a red-hot bit of charcoal would be to us. No chemical flame would be worth bothering with.

We have evolved for light emitted by a body at approximately fifty-five hundred degrees Absolute—the Sun. Our environment has modified our spectrum sensitivity; we are most sensitive to the yellow-green region of the spectrum—the color light you get in a forest, after the light of sun and sky has filtered down through green leaves.

The eyes of that people would be adapted to, say, the emission of a body at forty thousand degrees Absolute, filtered by the atmosphere so that only that portion below the far ultraviolet came through.

It is technically possible to imitate our sun's light to some extent; a tungsten filament can be operated at three thousand degrees, a carbon arc will go up almost to four thousand degrees. Fluorescent lamps, using ultraviolet as the prime source and chemical "transformers" to convert it down to our visual levels, can almost perfectly duplicate the blue-white light of a day when very light white clouds obscure the sun. That requires a color-temperature of twelve thousand degrees.

But the lighting engineers of the people of the blue-violet sun get no help that way—they want ultraviolet to begin with! A mercury vapor arc might do a fair job—if they used fused-quartz tubes. The clearest glass would, to them, be a regular traffic-light red.

And mercury vapor lamps would not be at all satisfactory; mercury vapor would probably look, to them, much as sodium vapor lamps do to us. Certainly sodium gives the ideal, maximum-visibility yellowish light. But it gives only one narrow band in the spectrum; a rich, red velvet is a muddy black under that illumination—and so is a brilliant blue.

Maybe the lighting engineers could get somewhere with fluorescent light, at that. X rays cause fluorescence—but finding a substance that would let the ultraviolet light produced escape without letting dangerous X rays escape, too, would be a neat trick.

Also, home-lighting equipment that involved quarter-million-volt apparatus wouldn't be too handy or too safe.

We humans have enough of a problem generating light for our uses; be glad old Sol wasn't a blue-violet sun, for we'd probably never have gotten the necessary technical civilization developed. No primitive group can evolve light-sources giving ultraviolet light, and I wonder whether a high technical civilization could evolve without any source of artificial light.

The Editor.

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I TRAINED THESE MEN

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The Radio repair business is booming as manufacturers have stopped making new sets and the country's 57,400,000 home and auto sets are becoming older, needing more repairs, new tubes, parts. This is opening new opportunities for full time and part time Radio Technicians to get good jobs, or to open their own Radio repair businesses. Radio Technicians and Operators hold good jobs in the country's 882 Broadcasting Stations and in Aviation, Police, Commercial, Marine and Government Radio. Loud Speaker Systems give good jobs to many. The Government is calling for Civilian Radio Technicians and Operators. Government orders for millions of dollars worth of Radio equipment offer opportunities in Radio factories. Men with Radio Training are in line for extra rank and pay in the Army and Navy. Many Radio developments such as Television, held back by the war, will make Radio a live-wire field for the future.

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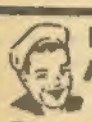

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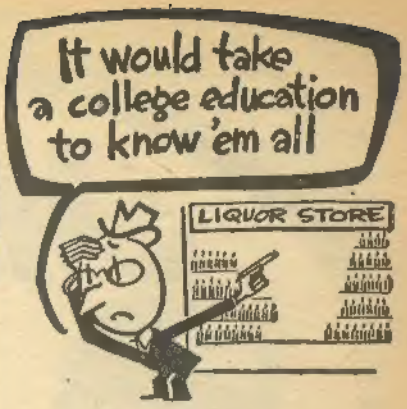


I Went Nuts in Liquor Stores
– by don herold

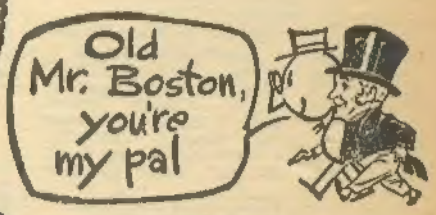
I used to go crazy in liquor stores, trying to decide which brand to buy. So many brands! The confusion is terrific for the layman liquor layer-inner.

Then a friend told me his system. He said "I've settled on Old Mr. Boston as MY brand—no matter what type of fine liquor I want."

Me—I have too, now.

It turns out that Old Mr. Boston is the one brand name under which you can buy almost every known type of fine liquor. Other big companies make many liquors, but they give them many different names. It's baffling! It's befuddling!

In the Old Mr. Boston line you can buy more than 30 different liquors, all under the one name, easy to remember because of the genial old trademark gent, Old Mr. Boston—and all easy on the palate and pocketbook.



You know Boston. And you know its fine old reputation for craftsmanship. Well, you can smack a taste of the old town's 300-year-old reputation for quality in every drop of every Old Mr. Boston product.

So why not try the Old Mr. Herold plan and use Old Mr. Boston "as a handle by which to call your shots" when you want fine liquors?

Illustrated by Orban

WALDO

By Anson MacDonald

● They called them "broomsticks" because the aircars were practically invisible, except for a drive shaft and the passengers. It was bad, though, when they began failing for no known reason. But scientists went off the deep end when a hex doctor made their broomsticks fly again!

The act was billed as ballet tap—which does not describe it.

His feet created an intricate tympany of crisp, clean taps. There was a breath-catching silence as he leaped high into the air, higher than a human being should—and performed, while floating there, a fantastically improbable *entrechat douze*.

He landed on his toes, apparently poised, yet producing a fortissimo of thunderous taps.

The spotlights cut, the stage lights came up. The audience stayed silent a long moment, then realized it was time to applaud, and *gave*.

He stood facing them, letting the wave of their emotion sweep through him. He felt as if he could lean against it; it warmed him through to his bones.

It was wonderful to dance, glorious to be applauded, to be *liked*, to be *wanted*.

When the curtain rang down for the last time he let his dresser lead him away. He was always a little bit drunk at the end of a performance; dancing was a joyous intoxication even in rehearsal, but to have an audience lifting him, carrying him along, applauding him—he never grew jaded to it. It was always new and heartbreakingly wonderful.

"This way, chief. Give us a little smile." The flash bulb flared. "Thanks."

"Thank *you*. Have a drink." He motioned toward one end of his dressing room. They were all such nice fellows, such grand guys—the reporters, the photographers—all of them.

"How about one standing up?" He started to comply, but his dresser, busy with one slipper, warned him:

"You operate in half an hour."

"Operate?" the news photographer said. "What's it this time?"

"A left cerebrectomy," he answered.

"Yeah? How about covering it?"

"Glad to have you—if the hospital doesn't mind."

"We'll fix that."

Such grand guys.

"—trying to get a little different angle on a feature article." It was a feminine voice, near his ear. He looked around hastily, slightly confused. "For example, what made you decide to take up dancing as a career?"

"I'm sorry," he apologized. "I didn't hear you. I'm afraid it's pretty noisy in here."

"I said, why did you decide to take up dancing?"

"Well, now, I don't quite know how to answer that. I'm afraid we would have to go back quite a way—"

James Stevens scowled at his assistant engineer. "What have you got to look happy about?" he demanded.

"It's just the shape of my face," his assistant apologized. "Try laughing at this one: There's been another crash."

"Oh, cripes! Don't tell me—let me guess. Passenger or freight?"

"A Climax duo-freighter on the Chicago-Salt Lake shuttle, just west of North Platte. And, chief—"

"Yes?"

"The Big Boy wants to see you."

"That's interesting. That's very, very interesting. Mac—"

"Yeah, chief."

"How would you like to be Chief Traffic Engineer of North American Power-Air? I hear there's going to be a vacancy."

Mac scratched his nose. "Funny that you should mention that, chief. I was just going to ask you what kind of a recommendation you could give me in case I went back into civil engineering. Ought to be worth something to you to get rid of me."

"I'll get rid of you—right now. You bust out to Nebraska, find that heap before the souvenir hunters tear it apart, and bring back its deKalbs and its control board."

"Trouble with cops, maybe?"

"You figure it out. Just be sure you come back."

"'With my slipstick, or on it.'"

Stevens' office was located immediately adjacent to the zone power plant; the business offices of North American were located in a hill, a good three quarters of a mile away. There was the usual interconnecting tunnel; Stevens entered it and deliberately chose the low-speed slide in order to have more time to think before facing the boss.

By the time he arrived he had made up his mind, but he did not like the answer.

The Big Boy—Stanley F. Gleason, Chairman of the Board—greeted him quietly. "Come in, Jim. Sit down. Have a cigar."

Stevens slid into a chair, declined the cigar and pulled out a cigarette, which he lit while looking around. Besides the chief and himself, there were present Harkness, head of the legal staff, Dr. Rambeau, Stevens' opposite number for research, and Striebel, the chief engineer for city power. Us five and no more, he thought grimly—all the heavyweights and none of the middleweights. Heads will roll!—starting with mine.

"Well," he said, almost belligerently, "we're all here. Who's got the cards? Do we cut for deal?"

Harkness looked faintly distressed by the impropriety; Rambeau seemed too sunk in some personal gloom to pay any attention to wisecracks in bad taste. Gleason ignored it. "We've been trying to figure a way out of our troubles, James. I left word for you on the chance that you might not have left."

"I stopped by simply to see if I had any personal mail," Stevens said bitterly. "Otherwise I'd be on the beach at Miami, turning sunshine into Vitamin D."

"I know," said Gleason, "and I'm sorry. You deserve that vacation, Jimmie. But the situation has gotten worse instead of better. Any ideas?"

"What does Dr. Rambeau say?"

Rambeau looked up momentarily. "The deKalb receptors can't fail," he stated.

"But they do."

"They can't. You've operated them improperly." He sunk back into his personal prison.

Stevens turned back to Gleason and spread his hands. "So far as I know, Dr. Rambeau is right—but if the fault lies in the engineering department, I haven't been able to locate it. You can have my resignation."

"I don't want your resignation," Gleason said gently. "What I want is results. We have a responsibility to the public."

"And to the stockholders," Harkness put in.

"That will take care of itself, if we solve the other," Gleason observed. "How about it, Jimmie? Any suggestions?"

Stevens bit his lip. "Just one," he announced, "and one I don't like to make. Then I look for a job peddling magazine subscriptions."

"So? Well, what is it?"

"We've got to consult Waldo."

Rambeau suddenly snapped out of his apathy. "What! That charlatan? This is a matter of *science*."

Harkness said, "Really, Dr. Stevens—"

Gleason held up a hand. "Dr. Stevens' suggestion is logical. But I'm afraid it's a little late, Jimmie. I talked with him last week."

Harkness looked surprised; Stevens looked annoyed as well. "Without letting me know?"

"Sorry, Jimmie. I was just feeling him out. But it's no good—his terms, to us, amount to confiscation."

"Still sore over the Hathaway patents?"

"Still nursing his grudge."

"You should have let me handle the matter," Harkness put in. "He can't do this to us—there is public interest involved. Retain him, if need be, and let the fee be adjudicated in equity. I'll arrange the details."

"I'm afraid you would," Gleason said dryly. "Do you think a court order will make a hen lay an egg?"

Harkness looked indignant, but shut up.

Stevens continued, "I would not have suggested going to Waldo if I had not had an idea as to how to approach him. I know a friend of his—"

"A friend of *Waldo?* I didn't know he had any."

"This man is sort of an uncle to him—his first physician. With his help I might get on Waldo's good side."

Dr. Rambeau stood up. "This is intolerable," he announced. "I must ask you to excuse me." He did not wait for an answer, but strode out, hardly giving the door time to open in front of him.

Gleason followed his departure with worried eyes. "Why does he take it so hard, Jimmie? You would think he hated Waldo personally."

"Probably he does, in a way. But it's more than that—his whole universe is toppling. For the last twenty years, ever since Pryor's reformulation of General Field Theory did away with Heisenberg's Uncertainty Principle, physics has been considered an exact science. The power failures and transmission failures we have been suffering are a terrific nuisance to you and to me, but to Dr. Rambeau they amount to an attack on his faith. Better keep an eye on him."

"Why?"

"Because he might come unstuck entirely. It's a pretty serious matter for a man's religion to fail him."

"Hm-m-m. How about yourself? Doesn't it hit you just as hard?"

"Not quite. I'm an engineer . . . from Rambeau's point of view just a high-priced tinker. Difference in orientation. Not but what I'm pretty upset."

The audio circuit of the communicator on Gleason's desk came to life. "Calling Chief Engineer Stevens—calling Chief Engineer Stevens." Gleason flipped the tab.

"He's here. Go ahead."

"Company code, translated. Message follows: 'Cracked up four miles north of Cincinnati. Shall I go on to Nebraska, or bring in the you-know-what from my own crate?' Message ends. Signed 'Mac.'"

"Tell him to *walk* back!" Stevens said savagely

"Very well, sir." The instrument cut off.

"Your assistant?" asked Gleason.

"Yes. That's about the last straw, chief. Shall I wait and try to analyze this failure, or shall I try to see Waldo?"

"Try to see Waldo."

"O. K. If you don't hear from me, just send my severance pay care of Palmdale Inn, Miami. I'll be the fourth beachcomber from the right."

Gleason permitted himself an unhappy smile. "If you *don't* get results, I'll be the fifth. Good luck."

"So long."

When Stevens had gone, Chief Stationary Engineer Striebel spoke up for the first time. "If the power to the cities fails," he said softly, "you know where I'll be, don't you?"

"Where? Beachcomber number six?"

"Not likely. I'll be number one, in my spot—first man to be lynched."

"But the power to the cities *can't* fail. You've got too many cross-connects and safety devices."

"Neither can the deKalbs fail, supposedly. Just the same—thing about Sublevel 7 in Pittsburgh, with the lights out. Or, rather, don't think about it!"

Doc Grimes let himself into the above-ground access which led into his home, glanced at the announcer and noted with mild, warm interest that someone close enough to him to possess his house combination was inside. He moved ponderously downstairs, favoring his game leg, and entered the lounging room.

"Hi, Doc!" James Stevens got up when the door snapped open and came forward to greet him.

"H'lo, James. Pour yourself a drink. I see you have. Pour me one."

"Right."

While his friend complied, Grimes shucked himself out of the outlandish anachronistic greatcoat he was wearing and threw it more or less in the direction of the robing alcove. It hit the floor heavily, much more heavily than its appearance justified, despite its unwieldy bulk. It clunked.

Stooping, he peeled off thick overtrousers as massive as the coat. He was dressed underneath in conventional business tights in blue and sable. It was not a style that suited him. To an eye unsophisticated in matters of civilized dress—let us say the mythical Man-from-Antares—he might have seemed uncouth, even unsightly. He looked a good bit like an elderly, fat beetle.

James Stevens' eye made no note of the tights, but he looked with disapproval on the garments

which had just been discarded. "Still wearing that fool armor," he commented.

"Certainly."

"Damn it, Doc—you'll make yourself sick, carrying that junk around. It's unhealthy."

"Danged sight sicker if I don't."

"Rats! *I* don't get sick and *I* don't wear armor—outside the lab."

"You should." Grimes walked over to where Stevens had reseated himself. "Cross your knees." Stevens complied; Grimes struck him smartly below the kneecap with the edge of his palm. The reflex jerk was barely perceptible. "Lousy," he remarked, then peeled back his friend's right eyelid.

"You're in poor shape," he added, after a moment.

Stevens drew away impatiently. "*I'm* all right. It's you we're talking about."

"What about me?"

"Well— Damnation, Doc, you're throwing away your reputation. They talk about you."

Grimes nodded. "I know. 'Poor old Gus Grimes—a slight touch of cerebral termites.' Don't worry about my reputation; I've always been out of step. What's your fatigue index?"

"I don't know—it's all right."

"It is, eh? I'll wrestle you, two falls out of three."

Stevens rubbed his eyes. "Don't needle me, Doc. I'm rundown. I know that—but it isn't anything but overwork."

"Humph! James, you are a fair-to-middlin' radiation physicist—"

"Engineer."

"—engineer. But you're no medical man. You can't expect to pour every sort of radiant energy through the human system year after year and not pay for it. It wasn't designed to stand it."

"But I wear armor in the lab. You knqw that."

"Surely. And how about outside the lab?"

"But— Look, Doc—I hate to say it, but your whole thesis is ridiculous. Sure there is radiant energy in the air these days, but nothing harmful. All the colloidal chemists agree—"

"Colloidal fiddlesticks!"

"But you've got to admit that biological economy is a matter of colloidal chemistry."

"I've got to admit nothing. I'm not contending that colloids are not the fabric of living tissue—they are. But I've maintained for forty years that it was dangerous to expose living tissue to assorted radiation without being sure of the effect. From an evolutionary standpoint the human animal is habituated to and adapted to only the natural radiation of the sun—and he can't stand that any too well, even under a thick blanket of ionization. Without that blanket—did you ever see a solar-X type cancer?"

"Of course not."

"No, you're too young. *I* have. Assisted at the autopsy of one, when I was an intern. Chap was on the Second Venus Expedition. Four hundred and thirty-eight cancers we counted in him, then gave up."

"Solar-X is whipped."

"Sure it is. But it ought to be a warning. You bright young squirts can cook up things in your labs that we medicos can't begin to cope with. We're behind—bound to be. We usually don't know what's happened until the damage is done. This time you've torn it." He sat down heavily and suddenly looked as tired and whipped as did his younger friend.

Stevens felt the sort of tongue-tied embarrassment a man may feel when a dearly beloved friend falls in love with an utterly worthless person. He wondered what he could say that would not seem rude.

He changed the subject. "Doc, I came over because I had a couple of things on my mind—"

"Such as?"

"Well, a vacation for one. I know I'm rundown—I've been overworked and a vacation seems in order. The other is your pal, Waldo."

"Huh?"

"Yeah. Waldo Farthingwaite Jones, bless his stiff-necked, bad-tempered heart."

"Why Waldo? You haven't suddenly acquired an interest in *myasthenia gravis*, have you?"

"Hell, no. I don't care what's wrong with him physically. He can have hives, dandruff, or the galloping never-get-overs for all I care. I hope he has. What I want is to pick his brains."

"So?"

"I can't do it alone. Waldo doesn't help people; he *uses* them. You're his only normal contact with people."

"That is not entirely true—"

"Who else?"

"You misunderstand me. He has *no* normal contacts. I am simply the only person who dares to be rude to him."

"But I thought— Never mind. D'you know, this is an inconvenient set-up? Waldo is the man we've got to have—why should it come about that a genius of his caliber should be so unapproachable, so immune to ordinary social demands? Oh, I know his disease has a lot to do with it, but why should *this* man have *this* disease? It's an improbable coincidence."

"It's not a matter of his infirmity," Grimes told him. "Or, rather, not in the way you put it. His weakness *is* his genius, in a way—"

"Huh?"

"Well—" Grimes turned his sight inward, let his mind roam back over his long association—lifelong, for Waldo—with this particular patient. He remembered his subliminal misgivings when he delivered the child. The infant had been sound

enough, superficially, except for a slight blueness. But, then, lots of babies were somewhat cyanotic in the delivery room. Nevertheless, he had felt a slight reluctance to give it the tunk on the bottom, the slap which would shock it into taking its first lungful of air.

But he had squelched his own feelings, performed the necessary "laying on of hands," and the freshly born human had declared its independence with a satisfactory squall. There was nothing else he could have done; he was a young G. P. then, who took his Hippocratic oath seriously. He still took it seriously, he supposed, even though he sometimes referred to it as the "hypocritical" oath. Still, he had been right in his feelings; there *had* been something rotten about that child—something that was not entirely *myasthenia gravis.*

He had felt sorry for the child at first, as well as having an irrational feeling of responsibility for its condition. Pathological muscular weakness is an almost totally crippling condition, since the patient has no unaffected limbs to retrain into substitutes. There the victim must lie, all organs, limbs, and functions present, yet so pitifully, completely weak as to be unable to perform any normal action normally. He spends his life in a condition of exhausted collapse such as you or I might reach at the finish line of a grueling cross-country run. No help for him, and no relief.

During Waldo's childhood he had hoped constantly that the child would die, since he was so obviously destined for tragic uselessness, while simultaneously, as a physician, doing everything within his own skill and the skills of numberless consulting specialists to keep the child alive and to cure it.

Naturally, Waldo could not attend school—Grimes ferreted out sympathetic tutors. He could indulge in no normal play; Grimes invented sickbed games which would not only stimulate Waldo's imagination but encourage him to use his flabby muscles to the full, weak extent of which he was capable.

Grimes had been afraid that the handicapped child, since it was not subjected to the usual maturing stresses of growing up, would remain infantile. He knew now, had known for a long time, that he need not have worried. Young Waldo grasped at what little life was offered him, learned thirstily, tried with a sweating tenseness of will to force his undisciplined muscles to serve him.

He was clever in thinking of dodges whereby to circumvent his muscular weakness. At seven he devised a method of controlling a spoon with two hands which permitted him—painfully—to feed himself. His first mechanical invention was made at ten.

It was a gadget which held a book for him, at any angle, controlled lighting for the book, and turned its pages. The gadget responded to fingertip pressure on a simple control panel. Naturally, Waldo could not build it himself, but he could conceive it, and explain it; the Farthingwaite-Joneses could well afford the services of a designing engineer to build the child's conception.

Grimes was inclined to consider this incident, in which the child Waldo acted in a role of intellectual domination over a trained mature adult neither blood relation nor servant, as a landmark in the psychological process whereby Waldo eventually came to regard the entire human race as his servants, his *hands*, present or potential.

"What's eating you, Doc?"

"Eh? Sorry, I was daydreaming. See here, son—you mustn't be too harsh on Waldo. I don't *like* him myself. But you must take him as a whole."

"*You* take him."

"*Shush.* You spoke of needing his genius. He wouldn't have been a genius if he had not been crippled. You didn't know his parents. They were good stock—fine, intelligent people—but nothing spectacular. Waldo's potentialities weren't any greater than theirs, but he had to do more with them to accomplish anything. He had to do everything the hard way. He *had* to be clever."

"Sure. Sure—but why should he be so utterly poisonous? Most big men aren't."

"Use your head. To get anywhere in his condition he had to develop a will, a driving one-track mind, with a total disregard for any other considerations. What would you expect him to be but stinking selfish?"

"I'd— Well, never mind. We need him and that's that."

"Why?"

Stevens explained.

It may plausibly be urged that the shape of a culture—its *mores*, evaluations, family organization, eating habits, living patterns, pedagogical methods, institutions, forms of government, and so forth—arise from the economic necessities of its technology. Even though the thesis be too broad and much over-simplified it is none the less true that much which characterized the Long Peace which followed the constitutional establishment of the United Nations grew out of the technologies which were hothouse-forced by the needs of the belligerents in the War of the Forties. Up to that time broadcast and beamcast were used only for commercial radio, with rare exceptions. Even telephony was done almost entirely by actual metallic connection from one instrument to another. If a man in Monterey wished to speak to his wife or partner in Boston, a physical, copper neuron stretched bodily across the continent from one to the other.

Radiant power was then a hop dream, found in Sunday Supplements and comic books.

A concatenation—no, a meshwork—of new developments was necessary before the web of copper covering the continent could be dispensed with. Power could not be broadcast economically; it was necessary to wait for the co-axial beam—a direct result of the imperative military shortages of the Great War. Radio telephony could not replace wired telephony until ultra micro-wave techniques made room in the ether, so to speak, for the traffic load. Even then it was necessary to invent a tuning device which could be used by a nontechnical person, a ten-year-old child let us say, as easily as the dial selector which was characteristic of the commercial wired telephone of the era then terminating.

Bell Laboratories cracked that problem; the solution led directly to the radiant power receptor, domestic type, keyed, sealed, and metered. The way was open for commercial radio power transmission—except in one respect: Efficiency. Aviation waited on the development of the Otto-cycle engine; the Industrial Revolution waited on the steam engine; radiant power waited on a really cheap, plentiful power source—since radiation of power is inherently wasteful, it was necessary to have power cheap and plentiful enough to waste.

The same war brought atomic energy. The physicists working for the United States army—the United States of North America had its own army then—failed to produce either a super-explosive or a satisfactory power source from $Uranium_{235}$; the notebooks recording their failures contained, when properly correlated, everything necessary to produce almost any other sort of nuclear reaction, even the so-called Solar Phoenix, the Hydrogen-Helium cycle which is the source of the sun's power.

The reaction whereby copper is broken down into phosphorus, $silicon_{29}$ and $helium_{8}$, plus degenerating chain reactions, was one of the several cheap and convenient means developed for producing unlimited and practically free power.

Radiant power became economically feasible—and inevitable.

Of course Stevens included none of this in his explanation to Grimes. Grimes was absent-mindedly aware of the whole dynamic process; he had seen radiant power grow up just as his grandfather had seen the development of aviation. He had seen the great transmission lines removed from the sky—"mined" for their copper; he had seen the heavy cables being torn from the dug-up streets of Manhattan. He might even recall his first independent-unit radiotelephone with its somewhat disconcerting double dial—he had gotten a lawyer in Buenos Aires on it when attempting to reach his neighborhood delicatessen. For two weeks he made all his local calls by having them relayed back from South America before he discovered that it made a difference which dial he used first.

At that time Grimes had not yet succumbed to the new style in architecture. The London Plan did not appeal to him; he liked a house above ground, where he could see it. When it became necessary to increase the floor space in his offices, he finally gave in and went subsurface not so much for the cheapness, convenience, and general all-around practicability of living in a tri-conditioned cave, but because he had already become a little worried about the possible consequences of radiation pouring through the human body. The fused-earth walls of his new residence were covered with lead; the roof of the cave had a double thickness. His hole in the ground was as near radiation-proof as he could make it.

"—the meat of the matter," Stevens was saying, "is that the delivery of power to transportation units has become erratic as the devil. Not enough yet to tie up traffic, but enough to be very disconcerting. There have been some nasty accidents; we can't keep hushing them up forever. I've got to do something about it."

"Why?"

"'Why?' Don't be silly. In the first place as traffic engineer for NAPA my bread and butter depends on it. In the second place the problem is upsetting in itself. A properly designed piece

of mechanism ought to work, all the time, every time. These don't, and we can't find out why not. Our staff mathematical physicists have about reached the babbling stage."

Grimes shrugged. Stevens felt annoyed by the gesture. "I don't think you appreciate the importance of this problem, Doc. Have you any idea of the amount of horsepower involved in transportation? Counting both private and commercial vehicles and common carriers North American Power-Air supplies more than half the energy used in this continent. We *have* to be right. You can add to that our city-power affiliate. No trouble there—yet. But we don't *dare* think what a city-power breakdown would mean."

"I'll give you a solution."

"Yeah? Well, give."

"Junk it. Go back to oil-powered and steam-powered vehicles. Get rid of these damned radiant-powered death traps."

"Utterly impossible. You don't know what you're saying. It took more than fifteen years to make the change-over. Now we're geared to it. Gus, if NAPA closed up shop, half the population of the northwest seaboard would starve, to say nothing of the lakes States and the Philly-Boston Axis."

"Hrrmph— Well, all I've got to say is that that might be better than the slow poisoning that is going on now."

Stevens brushed it away impatiently. "Look, Doc, nurse a bee in your bonnet if you like, but don't ask me to figure it into my calculations. Nobody else sees any danger in radiant power."

Grimes answered mildly. "Point is, son, they aren't looking in the right place. Do you know what was the high-jump record last year?"

"I never listen to the sports news."

"Might try it sometime. The record leveled off at seven foot two, 'bout twenty years back. Been dropping ever since. You might try graphing athletic records against radiation in the air, artificial radiation. Might find some results that would surprise you."

"Shucks, everybody knows there has been a swing away from heavy sports. The sweat-and-muscles fad simply died out, that's all. We've simply advanced into a more intellectual culture."

"Intellectual hogwash. People quit playing tennis and such because they are tired all the time. Look at you. You're a mess."

"Don't needle me, Doc."

"Sorry. But there has been a clear deterioration in the performance of the human animal. If we had decent records on such things I could prove it—but any physician who's worth his salt can *see* it, if he's got eyes in him and isn't wedded to a lot of fancy instruments. I can't prove what causes it, not yet, but I've a damned good hunch that it's caused by the stuff you peddle."

"Impossible. There isn't a radiation put on the air that hasn't been tested very carefully in the bio labs. We're neither fools nor knaves."

"Maybe you don't test 'em long enough. I'm not talking about a few hours, or a few weeks; I'm talking about the cumulative effects of years of radiant frequencies pouring through the tissues. What does that do?"

"Why, nothing—I believe."

"You believe, but you don't know. Nobody has ever tried to find out. F'rinstance—what effect does sunlight have on silicate glass? Ordinarily you would say 'none,' but you've seen desert glass?"

"That bluish-lavender stuff? Of course."

"Yes. A bottle turns colored in a few months in the Mojave Desert. But have you ever seen the windowpanes in the old houses on Beacon Hill?"

"I've never been on Beacon Hill."

"O. K., then I'll tell you. Same phenomena—only it takes a century or more, in Boston. Now tell me, you savvy physics—could you measure the change taking place in those Beacon Hill windows?"

"Mm-m-m—probably not."

"But it's going on, just the same. Has anyone ever tried to measure the changes produced in human tissue by thirty years of exposure to ultra short-wave radiation?"

"No, but—"

"No 'buts'. I see an effect. I've made a wild guess at a cause. Maybe I'm wrong. But I've felt a lot more spry since I've taken to invariably wearing my lead overcoat whenever I go out."

Stevens surrendered the argument. "Maybe you're right, Doc. I won't fuss with you. How about Waldo? Will you take me to him and help me handle him?"

"When do you want to go?"

"The sooner the better."

"Now?"

"Suits."

"Call your office."

"Are you ready to leave right now? It would suit me. As far as the front office is concerned, I'm on vacation; nevertheless, I've got this on my mind—I want to get at it."

"Quit talking and git."

They went topside to where their cars were parked. Grimes headed toward his, a big-bodied, old-fashioned Boeing family landeau. Stevens checked him. "You aren't planning to go in that? It 'u'd take us the rest of the day."

"Why not? She's got an auxiliary space drive, and she's tight. You could fly from here to the Moon and back."

"Yes, but she's so infernal slow. We'll use my 'broomstick.'"

Grimes let his eyes run over his friend's fusi-formed little speedster. Its body was as nearly invisible as the plastic industry could achieve. A surface layer, two molecules thick, gave it a refractive index sensibly identical with that of air. When perfectly clean it was very difficult to see. At the moment it had picked up enough casual dust and water vapor to be faintly seen—a ghost of a soap bubble of a ship.

Running down the middle, clearly visible through the walls, was the only metal part of the ship—the shaft, or, more properly, the axis core, and the spreading sheaf of deKalb receptors at its terminus. The appearance was enough like a giant witch's broom to justify the nickname. Since the saddles, of transparent plastic, were mounted tandem over the shaft so that the metal rod passed between the legs of the pilot and passengers, the nickname was doubly apt.

"Son," Grimes remarked, "I know I ain't pretty, nor am I graceful. Nevertheless, I retain a certain residuum of self-respect and some shreds of dignity. I am *not* going to tuck that thing between my shanks and go scooting through the air on it."

"Oh, rats! You're old-fashioned."

"I may be. Nevertheless, any peculiarities I have managed to retain to my present age I plan to hang on to. No."

"Look—I'll polarize the hull before we raise. How about it?"

"Opaque?"

"Opaque."

Grimes slid a regretful glance at his own frumpish boat, but assented by fumbling for the barely visible port of the speedster. Stevens assisted him; they climbed in and straddled the stick.

"Atta boy, Doc," Stevens commended, "I'll have you there in three shakes. That tub of yours probably won't do over five hundred, and Wheelchair must be all of twelve thousand miles up."

"I'm never in a hurry," Grimes commented, "and don't call Waldo's house 'Wheelchair'—not to his face."

"I'll remember," Stevens promised. He fumbled, apparently in empty air; the hull suddenly became dead-black, concealing them. It changed as suddenly to mirror-bright; the car quivered, then shot up out of sight.

Waldo F. Jones seemed to be floating in thin air at the center of a spherical room. The appearance was caused by the fact that he was indeed floating, in air. His house lay in a free orbit, with a period of just over twenty-four hours. No spin had been impressed on his home; the pseudogravity of centrifugal force was the thing he wanted least. He had left earth to get away from its gravitational field; he had not been down to the surface once in the seventeen years since his house was built and towed into her orbit—he never intended to do so for any purpose whatsoever.

Here, floating free in space in his own air-conditioned shell, he was almost free of the unbearable lifelong slavery to his impotent muscles. What little strength he had he could spend economically, in movement, rather than in fighting against the tearing, tiring weight of the Earth's thick field.

Waldo had been acutely interested in space flight since early boyhood, not from any desire to explore the depths, but because his boyish, overtrained mind had seen the enormous advantage—to him—in weightlessness. While still in his teens he had helped the early experimenters in space flight over a hump by supplying them with a control system which a pilot could handle delicately while under the strain of two or three gravities.

Such an invention was no trouble at all to him; he had simply adapted manipulating devices which he himself used in combating the overpowering weight of one gravity. The first successful and safe rocket contained relays which had once aided Waldo in moving himself from bed to wheelchair.

The deceleration tanks which are now standard equipment for the lunar mail ships traced their parentage to a flotation tank in which Waldo habitually had eaten and slept up to the time when he left the home of his parents for his present, somewhat unique, home. Most of his basic inventions had originally been conceived for his personal convenience, and only later adapted for commercial exploitation. Even the ubiquitous and grotesquely humanoid gadgets known universally as "waldoes"—Waldo F. Jones' Synchronous Reduplicating Pantograph, Pat. #296,001,437, new series, *et al*—passed through several generations of development and private use in Waldo's machine shop before he redesigned them for mass production. The first of them, a primitive gadget compared with the waldoes now to be found in every shop, factory, plant, and warehouse in the country, had been designed to enable Waldo to operate a metal lathe.

Waldo had resented the nickname the public had fastened on them—it struck him as overly familiar—but he had recognized coldly the business advantage to himself in having the public identify him verbally with a gadget so useful and important.

When the newscasters tagged his spacehouse "Wheelchair," one might have expected him to regard it as more useful publicity. That he did not so regard it, that he resented it and tried to put a stop to it, arose from another and peculiarly Waldo-ish fact: Waldo did not think of himself as a cripple.

He saw himself not as a crippled human being, but as something higher than human, the next step up, a being so superior as not to need the coarse, brutal strength of the smooth apes. Hairy apes,

smooth apes, then Waldo—so the progression ran in his mind. A chimpanzee, with muscles that hardly bulge at all, can tug as high as fifteen hundred pounds with one hand. This Waldo had proved by obtaining one and patiently enraging it into full effort. A well-developed man can grip one hundred fifty pounds with one hand. Waldo's own grip, straining until the sweat sprang out, had never reached fifteen pounds.

Whether the obvious inference were fallacious or true, Waldo believed in it, evaluated by it. Men were overmuscled *canaille*, smooth chimps. He felt himself at least ten times superior to them.

He had much to go on.

Though floating in air he was busy, quite busy. Although he never went to the surface of the Earth his business was there. Aside from managing his many properties he was in regular practice as a consulting engineer, specializing in motion analysis. Hanging close to him in the room were the paraphernalia necessary to the practice of his profession. Facing him was a four-by-five color-stereo television receptor. Two sets of co-ordinates, rectilinear and polar, crosshatched it. Another smaller receptor hung above it and to the right. Both receptors were fully recording, by means of parallel circuits conveniently out of the way in another compartment.

The smaller receptor showed the faces of two men, watching him. The larger showed a scene inside a large shop, hangarlike in its proportions. In the immediate foreground, almost full size, was a grinder in which was being machined a large casting of some sort. A workman stood beside it, a look of controlled exasperation on his face.

"He's the best you've got," Waldo stated to the two men in the smaller screen. "To be sure, he is clumsy and does not have the touch for fine work, but he is the superior to the other morons you call machinists."

The workman looked around as if trying to locate the voice. It was evident that he could hear Waldo, but that no vision receptor had been provided for him. "Did you mean that crack for me?" he said harshly.

"You misunderstand me, my good man," Waldo said sweetly. "I was complimenting you. I actually have hopes of being able to teach you the rudiments of precision work. Then we shall expect you to teach those butter-brained oafs around you. The gloves, please."

Near the man, mounted on the usual stand, were a pair of primary waldoes, elbow-length and human digited. They were floating on the line, in parallel with a similar pair physically in front of Waldo. The secondary waldoes, whose actions could be controlled by Waldo himself by means of his primaries, were mounted in front of the power tool in the position of the operator.

Waldo's remark had referred to the primaries near the workman. The machinist glanced at them, but made no move to insert his arms in them. "I don't take no orders from nobody I can't see," he said flatly. He looked sidewise out of the scene as he spoke.

"Now, Jenkins—" commenced one of the two men in the smaller screen.

Waldo sighed. "I really haven't the time nor the inclination to solve your problems of shop discipline. Gentlemen, please turn your pickup so that our petulant friend may see me."

The change was accomplished; the workman's face appeared in the background of the smaller of Waldo's screens, as well as in the larger. "There—is that better?" Waldo said gently. The workman grunted.

"Now . . . your name, please?"

"Alexander Jenkins."

"Very well, friend Alec—the gloves."

Jenkins thrust his arms into the waldoes and waited. Waldo put his arms into the primary pair before him; all three pairs, including the secondary pair mounted before the machine, came to life. Jenkins bit his lip, as if he found the sensation of having his fingers manipulated by the gauntlets he wore unpleasant.

Waldo flexed and extended his fingers gently; the two pairs of waldoes in the screen followed in exact, simultaneous parallelism. "Feel it, my dear Alec," Waldo advised. "Gently, gently—the sensitive touch. Make your muscles work for you." He then started hand movements of definite pattern; the waldoes at the power tool reached up, switched on the power, and began gently, gracefully, to continue the machining of the casting. A mechanical hand reached down, adjusted a vernier, while the other increased the flow of oil cooling the cutting edge. "Rhythm, Alec, rhythm. No jerkiness, no unnecessary movement. Try to get in time with me."

The casting took shape with deceptive rapidity, disclosed what it was—the bonnet piece for an ordinary three-way nurse. The chucks drew back from it; it dropped to the belt beneath, and another rough casting took its place. Waldo continued with unhurried skill, his finger motions within his waldoes exerting pressure which would need to be measured in fractions of ounces, but the two sets of waldoes paralleled to him thousands of miles below followed his motions accurately and with force appropriate to heavy work at hand.

Another casting landed on the belt—several more. Jenkins, although not called upon to do any work in his proper person, tired under the strain of attempting to anticipate and match Waldo's motions. Sweat dripped down his forehead, ran off his nose, accumulated on his chin.

Between castings he suddenly withdrew his arms from the paralleled primaries. "That's enough," he announced.

"One more, Alec. You are improving."

"No!" He turned as if to walk off. Waldo made a sudden movement, so sudden as to strain him, even in his weight-free environment. One steel hand of the secondary waldoes lashed out, grasped Jenkins by the wrist.

"Not so fast, Alec."

"Let go of me!"

"Softly, Alec, softly. You'll do as you are told. *Won't you?*" The steel hand clamped down hard, twisted—Waldo had exerted all of two ounces of pressure.

Jenkins grunted. The one remaining spectator—one had left soon after the lesson started—said, "Oh, I say—Mr. Jones!"

"Let him obey, or fire him. You know the terms of my contract."

There was a sudden cessation of stereo and sound, cut from the Earth end. It came back on a few seconds later. Jenkins was surly, but no longer recalcitrant. Waldo continued as if nothing had happened. "Once more, my dear Alec."

When the repetition had been completed, Waldo directed, "Twenty times, wearing the wrist and elbow lights with the chronanalyzer in the picture. I shall expect the superposed strips to match, Alec." He cut off the larger screen without further words and turned to the watcher in the smaller screen. "Same time tomorrow, McNye. Progress is satisfactory. In time we'll turn this madhouse of yours into a modern plant." He cleared that screen without saying good-by.

Waldo terminated the business interview somewhat hastily because he had been following with one eye certain announcements on his own local information board. A craft was approaching his house. Nothing strange about that; tourists were forever approaching and being pushed away by his autoguardian circuit. But this craft had the approach signal, was now clamping to his threshold flat. It was a broomstick, but he could not place the license number. Florida license—whom did he know with a Florida license?

He immediately realized that he knew no one who possessed his approach signal—that list was *very* short—and who could also reasonably be expected to sport a Florida license. The suspicious defensiveness with which he regarded the entire world asserted itself; he cut in the circuit whereby he could control by means of his primary waldoes the strictly illegal but highly lethal inner defenses of his home. The craft was opaqued—he did not like that.

A youngish man wormed his way out. Waldo looked him over. A stranger—face vaguely familiar perhaps. An ounce of pressure in the primaries and the face would cease to be a face, but Waldo's actions were under cold cortical control; he held his fire. The man turned, as if to assist another passenger. Yes, there was another. Uncle Gus! —but the doddering old fool had brought a stranger with him. He knew better than that. He knew how Waldo felt about strangers!

Nevertheless, he released the outer lock of the reception room and let them in.

Gus Grimes snaked his way through the lock, pulling himself from one handrail to the next, and panting a little, as he always did when forced to move weight-free. Matter of diaphragm control, he told himself as he always did, can't be the exertion. Stevens streaked in after him, displaying a groundhog's harmless pride in handling himself well in space conditions. Grimes arrested himself just inside the reception room, grunted, and spoke to a man-sized dummy waiting there. "Hello, Waldo."

The dummy turned its eyes and head slightly. "Greetings, Uncle Gus. I do wish you would remember to phone before dropping in. I would have had your special dinner ready."

"Never mind. We may not be here that long. Waldo, this is my friend, Jimmie Stevens."

The dummy faced Stevens. "How do you do, Mr. Stevens?" the voice said formally. "Welcome to Freehold."

"How do you do, Mr. Jones?" Stevens replied, and eyed the dummy curiously. It was really surprisingly lifelike; he had been taken in by it at first. A "reasonable facsimile"—come to think of it, he had heard of this dummy. Except in vision screen few had seen Waldo in his own person. Those who had business at Wheelchair—no, "Freehold," he must remember that—those who had business at Freehold heard a voice and saw this simulacrum.

"But you *must* stay for dinner, Uncle Gus," Waldo continued. "You can't run out on me like that—you don't come often enough for that. I can stir something up."

"Maybe we will," Grimes admitted. "Don't worry about the menu. You know me—I can eat a turtle *with* the shell."

It had really been a bright idea, Stevens congratulated himself, to get Doc Grimes to bring him. Not here five minutes and Waldo was insisting on them staying for dinner. Good omen!

He had not noticed that Waldo had addressed the invitation to Grimes alone, and that it had been Grimes who had assumed the invitation to be for both of them.

"Where are you, Waldo?" Grimes continued. "In the lab?" He made a tentative movement, as if to leave the reception room.

"Oh, don't bother," Waldo said hastily. "I'm sure you will be more comfortable where you

are. Just a moment and I will put some spin on the room so that you may sit down."

"What's eating you, Waldo?" Grimes said testily. "You know I don't insist on weight. And I don't care for the company of your talking doll. I want to see you." Stevens was a little surprised by the older man's insistence; he had thought it considerate of Waldo to offer to supply acceleration. Weightlessness put him a little on edge.

Waldo was silent for an uncomfortable period. At last he said frigidly, "Really, Uncle Gus, what you ask is out of the question. You must be aware of that."

Grimes did not answer him. Instead, he took Stevens' arm. "Come on, Jimmie. We're leaving."

"Why, Doc! What's the matter?"

"Waldo wants to play games. I don't play games."

"But—"

"Ne' mind! Come along. Waldo, open the lock."

"Uncle Gus!"

"Yes, Waldo?"

"Your guest—you vouch for him?"

"Naturally, you dumb fool, else I wouldn't have brought him."

"You will find me in my workshop. The way is open."

Grimes turned to Stevens. "Come along, son."

Stevens trailed after Grimes as one fish might follow another, while taking in with his eyes as much of Waldo's fabulous house as he could see. The place was certainly unique, he conceded to himself, unlike anything he had ever seen. It completely lacked up-and-down orientation. Space craft, even space stations, although always in free fall with respect to any but internally impressed accelerations, invariably are designed with up-and-down; the up-and-down axis of a ship is determined by the direction of its accelerating drive; the up-and-down of a space station is determined by its centrifugal spin.

Some few police and military craft use more than one axis of acceleration; their up-and-down shifts therefore and their personnel must be harnessed when the ship maneuvers. Some space stations apply spin only to living quarters. Nevertheless the rule is general; human beings are used to weight; all their artifacts have that assumption implicit in their construction—except Waldo's house.

It is hard for a groundhog to dismiss the notion of weight. We seem to be born with an instinct which demands it. If one thinks of a vessel in a free orbit around the Earth, one is inclined to think of the direction toward the Earth as "down," to think of oneself as standing or sitting on that wall of the ship, using it as a floor. Such a concept is completely mistaken. To a person inside a freely falling body there is no sensation of weight whatsoever and no direction of up-and-down, except that which derives from the gravitational field of the vessel itself. As for the latter, neither Waldo's house, nor any space craft as yet built, is massive enough to produce a field dense enough for the human body to notice it. Believe it or not, that is true. It takes a mass as gross as a good-sized planetoid to give the human body a feeling of weight.

It may be objected that a body in a free orbit around the Earth is not a freely falling body. The concept involved is human, Earth-surface in type, and completely erroneous. Free flight, free fall, and free orbit are equivalent terms. The Moon falls constantly toward the Earth, the Earth falls constantly toward the Sun, but the sidewise vector of their several motions prevents them from approaching their primaries. It is free fall none the less. Consult any ballistician or any astrophysicist.

Where there is free fall there is no sensation of weight. A gravitational field must be opposed to be detected—by the human body.

Some of these considerations passed through Stevens' mind as he handwalked his way to Waldo's workshop. Waldo's home had been constructed without any consideration being given to up-and-down. Furniture and apparatus were affixed to any wall; there was no "floor." Decks and platforms were arranged at any convenient angle and of any size or shape, since they had nothing to do with standing or walking. Properly speaking, they were bulkheads and working surfaces rather than decks. Furthermore, equipment was not necessarily placed close to such surfaces; frequently it was more convenient to locate it with space all around it, held in place by light guys or slender stanchions.

The furniture and equipment was all odd in design and frequently odd in purpose. Most furniture on Earth is extremely rugged and at least ninety percent of it has a single purpose—to oppose, in one way or another, the acceleration of gravity. Most of the furniture in an Earth-surface —or subsurface—house are stator machines intended to oppose gravity. All tables, chairs, beds, couches, clothing racks, shelves, drawers, et cetera, have that as their one purpose. All other furniture and equipment have it as a secondary purpose which strongly conditions design and strength.

The lack of need for the rugged strength necessary to all terrestrial equipment resulted in a fairy-like grace in much of the equipment in Waldo's house. Stored supplies, massive in themselves, could be retained in convenient order by compartmentation of eggshell-thin transparent plastic. Ponderous machinery, which on Earth would necessarily be heavily cased and supported, was here either open to the air or covered by gossamerlike

envelopes and held stationary by light elastic lines.

Everywhere were pairs of waldoes, large, small, and life-size, with vision pickups to match. It was evident that Waldo could make use of the compartments through which they were passing without stirring out of his easy-chair—if he used an easy-chair. The ubiquitous waldoes, the insubstantial quality of the furniture, and the casual use of all walls as work or storage surfaces, gave the place a madly fantastic air. Stevens felt as if he were caught in a Disney.

So far the rooms were not living quarters. Stevens wondered what Waldo's private apartments could be like and tried to visualize what equipment would be appropriate. No chairs, no rugs, no bed. Pictures perhaps. Something pretty clever in the way of indirect lighting, since the eyes might be turned in any direction. Communication instruments might be much the same. But what would a washstand be like? Or a water tumbler? A trap bottle for the last—or would any container be necessary at all? He could not decide and realized that even a competent engineer may be confused in the face of mechanical conditions strange to him.

What constitutes a good ash tray when there is no gravity to hold the debris in place? Did Waldo smoke? Suppose he played solitaire; how did he handle the cards? Magnetized cards perhaps, and a magnetized playing surface.

"In through here, Jim." Grimes steadied himself with one hand, gesturing with the other. Stevens slid through the manhole indicated. Before he had had time to look around he was startled by a menacing bass growl. He looked up; charging through the air straight at him was an enormous mastiff, lips drawn back, jaws slavering. Its front legs were spread out stiffly as if to balance in flight; its hind legs were drawn up under its lean belly. By voice and manner it announced clearly its intention of tearing the intruder into pieces, then swallowing the pieces.

"Baldur!" A voice cut through the air from some point beyond. The dog's ferocity wilted, but it could not check its lunge. A waldo snaked out a good thirty feet and grasped it by the collar. "I am sorry, sir," the voice added. "My friend was not expecting you."

Grimes said, "Howdy, Baldur. How's your conduct?" The dog looked at him, whined, and wagged his tail. Stevens looked for the source of the commanding voice, found it.

The room was huge and spherical; floating in its center was a fat man—Waldo.

He was dressed conventionally enough in shorts and singlet, except that his feet were bare. His hands and forearms were covered by metallic gauntlets—primary waldoes. He was softly fat, double chin, dimples, smooth skin; he looked like a great, pink cherub, floating attendance on a saint. But the eyes were not cherubic, and the forehead and skull were those of a man. He looked at Stevens. "Permit me to introduce you to my pet," he said in a high, tired voice. "Give the paw, Baldur."

The dog offered a foreleg, Stevens shook it gravely. "Let him smell you, please."

The dog did so, as the waldo at his collar permitted him to come closer. Satisfied, the animal bestowed a wet kiss on Stevens' wrist. Stevens noted that the dog's eyes were surrounded by large circular patches of brown in contrast to his prevailing white and mentally tagged it the Dog with Eyes as Large as Saucers, thinking of the tale of the Soldier and the Fintbox. He made noises to it of "Good boy!" and "That's a nice old fellow!" while Waldo looked on with faint distaste.

"Heel, sir!" Waldo commanded when the ceremony was complete. The dog turned in midair, braced a foot against Stevens' thigh, and shoved, projecting himself in the direction of his master. Stevens was forced to steady himself by clutching at a handgrip. Grimes shoved himself away from the manhole and arrested his flight on a stanchion near their host. Stevens followed him.

Waldo looked him over slowly. His manner was not overtly rude, but was somehow, to Stevens, faintly annoying. He felt a slow flush spreading out from his neck; to inhibit it he gave his attention to the room around him. The space was commodious, yet gave the impression of being cluttered because of the assemblage of, well, *junk* which surrounded Waldo. There were half a dozen vision receptors of various sizes around him at different angles, all normal to his line of sight. Three of them had pickups to match. There were control panels of several sorts, some of which seemed obvious enough in their purposes—one for lighting which was quite complicated, with little ruby telltales for each circuit, one which was the keyboard of a voder, a multiplex television control panel, a board which seemed to be power relays although its design was unusual. But there were at least half a dozen which stumped Stevens completely.

There were several pairs of waldoes growing out of a steel ring which surrounded the working space. Two pairs, mere monkey fists in size, were equipped with extensors. It had been one of these which had shot out to grab Baldur by his collar. There were waldoes rigged near the spherical wall, too, including one pair so huge that Stevens could not conceive of a use for it. Extended, each hand spread quite six feet from little fingertip to thumb tip.

There were books in plenty on the wall, but no book shelves. They seemed to grow from the wall

like so many cabbages. It puzzled Stevens momentarily, but he inferred—correctly it turned out later—that a small magnet fastened to the binding did the trick.

The arrangement of lighting was novel, complex, automatic, and convenient for Waldo. But it was not so convenient for anyone else in the room. The lighting was, of course, indirect, but furthermore it was subtly controlled so that none of the lighting came from the direction in which Waldo's head was turned. There was no glare—for Waldo. Since the lights behind his head burned more brightly in order to provide more illumination for whatever he happened to be looking at, there was glare aplenty for anyone else. An electric eye circuit, obviously—Stevens found himself wondering just how simple such a circuit could be made.

Grimes complained about it. "Damn it, Waldo—get those lights under control. You'll give us headaches."

"Sorry, Uncle Gus." He withdrew his right hand from its gauntlet and placed his fingers over one of the control panels. The glare stopped. Light now came from whatever direction none of them happened to be looking, and much more brightly since the area source of illumination was much reduced. Lights rippled across the walls in pleasant patterns. Stevens tried to follow the ripples, a difficult matter since the set-up was made *not* to be seen. He found that he could do so by rolling his eyes without moving his head. It was movement of the head which controlled the lights; movement of an eyeball was a little too much for it.

"Well, Mr. Stevens, do you find my house interesting?" Waldo was smiling at him with faint superciliousness.

"Oh—quite! Quite! I believe that it is the most remarkable place I have ever been in."

"And what do you find remarkable about it?"

"Well—the lack of definite orientation, I believe. I suppose I am a bit of a groundlubber, but I keep expecting a floor underfoot and a ceiling overhead. That and the remarkable mechanical novelties."

"Mere matters of functional designs, Mr. Stevens; the conditions under which I live are unique, therefore my house is unique. The novelty you speak of consists mainly in the elimination of unnecessary parts and the addition of new conveniences."

"To tell the truth the most interesting thing I have seen yet is not a part of the house at all."

"Really? What is it, pray?"

"Your dog, Baldur." The dog looked around at the mention of his name. "I've never before met a dog who could handle himself in free flight."

Waldo smiled; for the first time his smile seemed gentle and warm. "Yes, Baldur is quite an acrobat. He's been at it since he was a puppy." He reached out and roughed the dog's ears, showing momentarily his extreme weakness, for the gesture had none of the strength appropriate to the size of the brute. The finger motions were flaccid, barely sufficient to disturb the coarse fur and to displace the great ears. But he seemed unaware, or unconcerned, by the disclosure. Turning back to Stevens he added, "But if Baldur amuses you, you must see Ariel."

"Ariel?"

Instead of replying, Waldo touched the keyboard of the voder, producing a musical whistling pattern of three notes. There was a rustling near the wall of the room "above" them; a tiny yellow shape shot toward them—a canary. It sailed through the air with wings folded, bullet fashion. A foot or so away from Waldo it spread its wings, cupping the air, beat them a few times with tail down and spread, and came to a dead stop, hovering in the air with folded wings. Not quite a dead stop, perhaps, for it drifted slowly, came within an inch of Waldo's shoulder, let down its landing gear, and dug its claws into his singlet.

Waldo reached up and stroked it with a fingertip. It preened. "No earth-hatched bird can learn to fly in that fashion," he stated. "I know. I lost half a dozen before I was sure that they were incapable of making the readjustment. Too much thalamus."

"What happens to them?"

"In a man you would call it acute anxiety psychosis. They try to fly; their own prime skill leads them to disaster. Naturally, everything they do is wrong and they don't understand it. Presently they quit trying, a little later they die. Of a broken heart, one might say, poetically." He smiled thinly. "But Ariel is a genius among birds. He came here as an egg; he invented, unassisted, a whole new school of flying." He reached up a finger, offering the bird a new perch, which it accepted.

"That's enough, Ariel. Fly away home."

The bird started the Bell Song from "Lakmé."

He shook it gently. "No, Ariel. Go to bed."

The canary lifted its feet clear of the finger, floated for an instant, then beat its wings savagely for a second or two to set course and pick up speed, and bulleted away whence he had come, wings folded, feet streamlined under.

"Jimmie's got something he wants to talk with you about," Grimes commenced.

"Delighted," Waldo answered lazily, "but shan't we dine first? Have you an appetite, sir?"

Waldo full, Stevens decided, might be easier to cope with than Waldo empty. Besides, his own midsection informed him that wrestling with a calory or two might be pleasant. "Yes, I have."

"Excellent." They were served.

Stevens was never able to decide whether Waldo had prepared the meal by means of his many namesakes, or whether servants somewhere out of sight had done the actual work. Modern food-preparation methods being what they were, Waldo could have done it alone—he, Stevens, batched it with no difficulty, and so did Gus. But he made a mental note to ask Doc Grimes at the first opportunity what resident staff, if any, Waldo employed. He never remembered to do so.

The dinner arrived in a small food chest, propelled to their midst at the end of a long, telescoping, pneumatic tube. It stopped with a soft sigh and held its position. Stevens paid little attention to the food itself—it was adequate and tasty, he knew—for his attention was held by the dishes and serving methods. Waldo let his own steak float in front of him, cut bites from it with curved surgical shears, and conveyed them to his mouth by means of dainty tongs. He made hard work of chewing.

"You can't get good steaks any more," he remarked. "This one is tough. God knows I pay enough—and complain enough."

Stevens did not answer. He thought his own steak had been tenderized too much; it almost fell apart. He was managing it with knife and fork, but the knife was superfluous. It appeared that Waldo did not expect his guests to make use of his own admittedly superior methods and utensils. Stevens ate from a platter clamped to his thighs, making a lap for it after Grimes' example by squatting in midair. The platter itself had been thoughtfully provided with sharp little prongs on its service side.

Liquids were served in small flexible skins, equipped with nipples. Think of a baby's plastic nursing bottle.

The food chest took the utensils away with a dolorous insufflation. "Will you smoke, sir?"

"Thank you." He saw what a weight-free ash tray necessarily should be. A long tube with a bell-shaped receptacle on its end, a slight suction in the tube, and ashes knocked into the bell were swept away, out of sight and mind.

"About that matter—" Grimes commenced again. "Jimmie here is Chief Traffic Engineer for North American Power-Air."

"What?" Waldo straightened himself, became rigid; his chest rose and fell. He ignored Stevens entirely. "Uncle Gus, do you mean to say that you have introduced an officer of *that* company into my—home?"

"Don't get your dander up. Relax. Damn it, I've warned you not to do anything to raise your blood pressure." Grimes propelled himself closer to his host and took him by the wrist, in the age-old fashion of a physician counting pulse. "Breathe slower. Whatcha trying to do? Go on an oxygen jag?"

Waldo tried to shake himself loose. It was a rather pitiful gesture; the old man had ten times his strength. "Uncle Gus, you—"

"Shut up!"

The three maintained a silence for several minutes, uncomfortable for at least two of them. Grimes did not seem to mind it.

"There," he said at last. "That's better. Now keep your shirt on and listen to me. Jimmie is a

nice kid and he has never done anything to you. And he has behaved himself while he's been here. You got no right to be rude to him, no matter who he works for. Matter of fact, you owe him an apology."

"Oh, really, now, Doc," Stevens protested, "I'm afraid I *have* been here somewhat under false colors. I'm sorry, Mr. Jones. I didn't intend it to be that way—I tried to explain when we arrived."

Waldo's face was hard to read. He was evidently trying hard to control himself. "Not at all, Mr. Stevens. I am sorry that I showed temper. It is perfectly true that I should not transfer to you any animus I feel for your employers . . . though God knows I bear no love for them."

"I know it. Nevertheless, I am sorry to hear you say it."

"I was cheated, do you understand? *Cheated*—by as rotten a piece of quasi-legal chicanery as has ever—"

"Easy, Waldo!"

"Sorry, Uncle Gus." He continued, his voice less shrill. "You know of the so-called Hathaway patents?"

"Yes, of course."

" 'So-called' is putting it mildly. The man was a mere machinist. Those patents are mine—" Waldo's version, as he proceeded to give it, was reasonably factual, Stevens felt, but quite biased and unreasonable. Perhaps Hathaway had been working, as Waldo alleged, simply as a servant, a hired artisan, but there was nothing to prove it, no contract, no papers of any sort. The man had filed certain patents, the only ones he had ever filed and admittedly Waldo-ish in their cleverness. Hathaway had then promptly died, and his heirs, through their attorneys, had sold the patents to a firm which had been dickering with Hathaway.

Waldo alleged that this firm had put Hathaway up to stealing from him, had caused him to hire himself out to Waldo for that purpose. But the firm was defunct; its assets had been sold to North American Power-Air. NAPA had offered a settlement; Waldo had chosen to sue. The suit went against him.

Even if Waldo were right, Stevens could not see any means by which the directors of NAPA could, legally, grant him any relief. The officers of a corporation are trustees for other people's money; if the directors of NAPA should attempt to give away property which had been adjudicated as belonging to the corporation, any stockholder could enjoin them before the act or recover from them personally after the act.

At least so Stevens thought. But he was no lawyer, he admitted to himself. The important point was that he needed Waldo's services, whereas Waldo held a bitter grudge against the firm he worked for.

He was forced to admit that it did not look as if Doc Grimes' presence were enough to turn the trick. "All that happened before my time," he began, "and naturally I know very little about it. I'm awfully sorry it happened. It's pretty uncomfortable for me, for right now I find myself in a position where I need your services very badly indeed."

Waldo did not seem displeased with the idea. "So? How does this come about?"

Stevens explained to him in some detail the trouble they had been having with the deKalb receptors. Waldo listened attentively. When Stevens had concluded he said, "Yes, that is much the same story your Mr. Gleason had to tell. Of course, as a technical man you have given a much more coherent picture than that money manipulator was capable of giving. But why do you come to me? I do not specialize in radiation engineering, nor do I have any degrees from fancy institutions."

"I come to you," Stevens said seriously, "for the same reason everybody else comes to you when they are really stuck with an engineering problem. So far as I know, you have an unbroken record of solving any problem you cared to tackle. Your record reminds me of another man—"

"Who?" Waldo's tone was suddenly sharp.

"Edison. He did not bother with degrees either, but he solved all the hard problems of his day."

"Oh, Edison— I thought you were speaking of a contemporary. No doubt he was all right in his day," he added with overt generosity.

"I was not comparing him to you. I was simply recalling that Edison was reputed to prefer hard problems to easy ones. I've heard the same about you; I had hopes that this problem might be hard enough to interest you."

"It is mildly interesting," Waldo conceded. "A little out of my line, but interesting. I must say, however, that I am surprised to hear you, an executive of North American Power-Air, express such a high opinion of my talents. One would think that, if the opinion were sincere, it would not have been difficult to convince your firm of my indisputable handiwork in the matter of the so-called Hathaway patents."

Really, thought Stevens, the man is impossible. A mind like a weasel. Aloud, he said, "I suppose the matter was handled by the business management and the law staff. They would hardly be equipped to distinguish between routine engineering and inspired design."

The answer seemed to mollify Waldo. He asked, "What does your own research staff say about the problem?"

Stevens looked wry. "Nothing helpful. Dr. Rambeau does not really seem to believe the data I bring him. He says it's impossible, but it makes

him unhappy. I really believe that he has been living on aspirin and nembutal for a good many weeks."

"Rambeau—" Waldo said slowly. "I recall the man. A mediocre mind. All memory and no intuition. I don't think I would feel discouraged simply because Rambeau is puzzled."

"You really feel that there is some hope?"

"It should not be too difficult. I had already given the matter some thought, after Mr. Gleason's phone call. You have given me additional data and I think I see at least two new lines of approach which may prove fruitful. In any case, there is always some approach—the correct one."

"Does that mean you will accept?" Stevens demanded, nervous with relief.

"Accept?" Waldo's eyebrows climbed up. "My dear sir, what in the world are you talking about? We were simply indulging in social conversation. I would not help your company under any circumstances whatsoever. I hope to see your firm destroyed utterly, bankrupt and ruined. This may well be the occasion."

Stevens fought to keep control of himself. Tricked! The fat slob had simply been playing with him, leading him on. There was no decency in him. In careful tones he continued, "I do not ask that you have any mercy on North American, Mr. Jones, but I appeal to your sense of duty. There is public interest involved. Millions of people are vitally dependent on the service we provide. Don't you see that the service *must* continue, regardless of you or me?"

Waldo pursed his lips. "No," he said, "I am afraid that does not affect me. The welfare of those nameless swarms of Earth crawlers is, I fear, not my concern. I have done more for them already than there was any need to do. They hardly deserve help. Left to their own devices, most of them would sink back to caves and stone axes. Did you ever see a performing ape, Mr. Stevens, dressed in a man's clothes and cutting capers on roller skates? Let me leave you with this thought: I am not a roller-skate mechanic for apes."

If I stick around here much longer, Stevens advised himself, there will be hell to pay. Aloud, he said, "I take it that is your last word?"

"You may so take it. Good day, sir. I enjoyed your visit. Thank you."

"Good-by. Thanks for the dinner."

"Not at all."

As Stevens turned away and prepared to shove himself toward the exit, Grimes called after him. "Jimmie, wait for me in the reception room."

As soon as Stevens was out of earshot, Grimes turned to Waldo and looked him up and down. "Waldo," he said slowly, "I always did know that you were one of the meanest, orneriest men alive, but—"

"Your compliments don't faze me, Uncle Gus."

"Shut up and listen to me. As I was saying, I knew you were too rotten selfish to live with, but this is the first time I ever knew you to be a four-flusher to boot."

"What do you mean by that? Explain yourself."

"Shucks! You haven't any more idea of how to crack the problem that boy is up against than I have. You traded on your reputation as a miracle man just to make him unhappy. Why, you cheap tinhorn bluffer, if you—"

"Stop it!"

"Go ahead," Grimes said quietly. "Run up your blood pressure. I won't interfere with you. The sooner you blow a gasket the better."

Waldo calmed down. "Uncle Gus—what makes you think I was bluffing?"

"Because I know you. If you had felt able to deliver the goods, you would have looked the situation over and worked out a plan to get NAPA by the short hair, through having something they had to have. That way you would have *proved* your revenge."

Waldo shook his head. "You underestimate the intensity of my feeling in the matter."

"I do like hell. I hadn't finished. About that sweet little talk you gave him concerning your responsibility to the race. You've got a head on you. You know damned well and so do I that of all people you can least afford to have anything serious happen to the set-up down on Earth. That means you don't see any way to prevent it."

"Why, what do you mean? I have no interest in such troubles—I'm independent of such things. You know me better than that."

"Independent, eh? Who mined the steel in these walls? Who raised that steer you dined on tonight? You're as independent as a queen bee, and about as helpless."

Waldo looked startled. He recovered himself and answered, "Oh, no, Uncle Gus. I really am independent. Why, I have supplies here for years."

"How many years?"

"Why . . . uh, five, about."

"And then what? You may live another fifty—*if* you have regular supply service. How do you prefer to die—starvation, or thirst?"

"Water is no problem," Waldo said thoughtfully, "as for supplies, I suppose I could use hydroponics a little more and stock up with some meat animals—"

Grimes cut him short with a nasty laugh. "Proved my point. You don't *know* how to avert it, so you are figuring some way to save your own skin. I know you. You wouldn't talk about starting a truck garden if you knew the answers."

Waldo looked at him thoughtfully. "That's not entirely true. I don't know the solution, but I do have some ideas about it. I'll bet you a half interest in hell that I can crack it. Now that you have called my attention to it, I must admit I am rather tied in with the economic system down below, and"—he smiled faintly—"I was never one to neglect my own interests. Just a moment—I'll call your friend."

"Not so fast. I came along for another reason, besides introducing Jimmie to you. It can't be just any solution; it's got to be a particular solution."

"What do you mean?"

"It's got to be a solution that will do away with the need for filling the air up with radiant energy."

"Oh, *that*. See here, Uncle Gus, I know how interested you are in your theory, and I've never disputed the possibility that you may be right, but you can't expect me to mix that into another and very difficult problem."

"Take another look. You're in this for self-interest. Suppose everybody was in the shape you are in."

"You mean my *physical condition?*"

"I mean just that. I know you don't like to talk about it, but we blamed well need to. If everybody was as weak as you are—presto! No coffee-and-cakes for Waldo. And that's just what I see coming. You're the only man I know of who can appreciate what it means."

"It seems fantastic."

"It is. But the signs are there for anybody to read who wants to. Epidemic *myasthenia*, not necessarily acute, but enough to raise hell with our mechanical civilization. Enough to play hob with your supply lines. I've been collating my data since I saw you last and drawing some curves. You should see 'em."

"Did you bring them?"

"No, but I'll send 'em up. In the meantime, you can take my word for it."

He waited. "Well, how about it?"

"I'll accept it as a tentative working hypothesis," Waldo said slowly, "until I see your figures. I shall probably want you to conduct some further research for me, on the ground—if your data is what you say it is."

"Fair enough. G'by." Grimes kicked the air a couple of times as he absent-mindedly tried to walk.

Stevens' frame of mind as he waited for Grimes is better left undescribed. The mildest thought that passed through his mind was a plaintive one about the things a man had to put up with to hold down what seemed like a simple job of engineering. Well, he wouldn't have the job very long. But he decided not to resign—he'd wait until they fired him; he wouldn't run out.

But he would damn well get that vacation before he looked for another job.

He spent several minutes wishing that Waldo were strong enough for him to be able to take a poke at him. Or kick him in the belly—that would be more fun!

He was startled when the dummy suddenly came to life and called him by name. "Oh, Mr. Stevens—"

"Huh? Yes?"

"I have decided to accept the commission. My attorneys will arrange the details with your business office."

He was too surprised to answer for a couple of seconds; when he did so the dummy had already gone dead. He waited impatiently for Grimes to show up.

"Doc!" he said, when the old man swam into view. "What got into him? How did you do it?"

"He thought it over and reconsidered," Grimes said succinctly. "Let's get going."

Stevens dropped Dr. Augustus Grimes at the doctor's home, then proceeded to his office. He had no more than parked his car and entered the tunnel leading toward the zone plant when he ran into his assistant. McLeod seemed a little out of breath. "Gee, chief," he said, "I hoped that was you. I've had 'em watching for you. I need to see you."

"What's busted now?" Stevens demanded apprehensively. "One of the cities?"

"No—what made you think so?"

"Go ahead with your story."

"So far as I know ground power is humming sweet as can be. No trouble with the cities. What I had on my mind is this: *I fixed my heap.*"

"Huh? You mean you fixed the ship you crashed in?"

"It wasn't exactly a crash. I had plenty of power in the reserve banks; when reception cut off, I switched to emergency and landed her."

"But you fixed it? Was it the deKalbs? Or something else?"

"It was the deKalbs all right. And they're fixed. But I didn't exactly do it myself—I got it done. You see—"

"What was the matter with them?"

"I don't know exactly. You see I decided that there was no point in hiring another skycar and maybe having another forced landing on the way home. Besides, it was my own crate I was flying and I didn't want to dismantle her just to get the deKalbs out and have her spread out all over the countryside. So I hired a crawler with the idea of taking her back all in one piece. I struck a deal with a guy who had a twelve-ton semitractor combination, and we—"

"For criminy's sake, make it march! What happened?"

"I'm trying to tell you. We pushed on into

Pennsylvania and we were making pretty fair time when the crawler broke down. The right lead wheel, ahead of the treads. Honest to goodness, Jim, those roads are something fierce."

"Never mind that. Why waste taxes on roads when ninety percent of the traffic is in the air? You messed up a wheel. So then what?"

"Just the same, those roads are a disgrace," McLeod maintained stubbornly. "I was brought up in that part of the country. When I was a kid the road we were on was six lanes wide and smooth as a baby's fanny. They ought to be kept up; we might need 'em some day." Seeing the look in his senior's eye he went on hastily, "The driver mugged in with his home office and they promised to send a repair car out from the next town. All told, it would take three, four hours, maybe more. Well, we were laid up in the county I grew up in. I says to myself, 'McLeod, this is a wonderful chance to return to the scenes of your childhood and the room where the sun came peeping in the morn.' Figuratively speaking, of course. Matter of fact our house didn't have any windows."

"I don't care if you were raised in a barrel!"

"Temper . . . temper—" McLeod said imperturbably. "I'm telling you this so you will understand what happened. But you aren't going to like it."

"I don't like it now."

"You'll like it less. I climbed down out of the cab and took a look around. We were about five miles from my home town—too far for me to want to walk it. But I thought I recognized a clump of trees on the brow of a little rise maybe a quarter of a mile off the road, so I walked over to see. I was right; just over the rise was the cabin where Gramps Schneider used to live."

"Gramps Snyder?"

"Not Snyder—*Sch*neider. Old boy we kids used to be friendly with. Ninety years older than anybody. I figured he was dead, but it wouldn't hurt any to walk down and see. He wasn't. 'Hello, Gramps,' I said. 'Come in, Hugh Donald,' he said. 'Wipe the feet on the mat.'

"I came in and sat down. He was fussing with something simmering in a stewpan on his baseburner. I asked him what it was. 'For morning aches,' he said. Gramps isn't exactly a hex doctor."

"Huh?"

"I mean he doesn't make a living by it. He raises a few chickens and garden truck and some of the Plain People—House Amish, mostly—give him pies and things. But he knows a lot about herbs and such.

"Presently he stopped and cut me a slice of shoofly pie. I told him *danke*. He said, 'You've been up-growing, Hugh Donald,' and asked me how I was doing in school. I told him I was doing pretty well. He looked at me again and said, 'But you have trouble fretting you.' It wasn't a question; it was a statement. While I finished the pie I found myself trying to tell him what kind of troubles I had.

"It wasn't easy. I don't suppose Gramps has ever been off the ground in his life. And modern radiation theory isn't something you can explain in words of one syllable. I was getting more and more tangled up when he stood up, put on his hat and said, 'We will see this car you speak about.'

"We walked over to the highway. The repair gang had arrived, but the crawler wasn't ready yet. I helped Gramps up onto the platform and we got into my bus. I showed him the deKalbs and tried to explain what they did—or rather what they were supposed to do. Mind you, I was just killing time.

"He pointed to the sheaf of antennæ and asked, 'These fingers—they reach out for the power?' It was as good an explanation as any so I let it ride. He said, 'I understand,' and pulled a piece of chalk out of his trousers, and began drawing lines on each antenna, from front to back. I walked up front to see how the repair crew were doing. After a bit Gramps joined me. 'Hugh Donald,' he says, 'the fingers—now they will make.'

"I didn't want to hurt his feelings, so I thanked him plenty. The crawler was ready to go; we said good-by and he walked back toward his shack. I went back to my car, and took a look in, just in case. I didn't think he could hurt anything, but I wanted to be sure. Just for the ducks of it I tried out the receptors. They worked!"

"What!" put in Stevens. "You don't mean to stand there and tell me an old witch doctor fixed your deKalbs."

"Not witch doctor—*hex* doctor. But you get the idea."

Stevens shook his head. "It's simply a coincidence. Sometimes they come back into order as spontaneously as they go out."

"That's what you think. Not this one. I've just been preparing you for the shock you're going to get. *Come take a look.*"

"What do you mean? Where?"

"In the inner hangar." While they walked to where McLeod had left his broomstick, he continued, "I wrote out a credit for the crawler pilot and flew back. I haven't spoken to anyone else about it. I've been biting my nails down to my elbows waiting for you to show up."

The skycar seemed quite ordinary. Stevens examined the deKalbs and saw some faint chalk marks on their metal sides—nothing else unusual. "Watch while I cut in reception," McLeod told him.

Stevens waited, heard the faint hum as the circuits became activized, and looked.

The antennæ of the deKalbs, each a rigid pencil

of metal, were bending, flexing, writhing like a cluster of worms. They were *reaching out*, like fingers.

Stevens remained squatting down by the deKalbs, watching their outrageous motion. McLeod left the control saddle, came back, and joined him. "Well, chief," he demanded, "tell me about it. Whaduh yuh make of it?"

"Got a cigarette?"

"What are those things sticking out of your pocket?"

"Oh! Yeah—sure." Stevens took one out, lighted it, and burned it halfway down, unevenly, with two long drags.

"Go on," McLeod urged. "Give us a tell. What makes it do that?"

"Well," Stevens said slowly, "I can think of three things to do next—"

"Yeah?"

"The first is to fire Dr. Rambeau and give his job to Gramps Schneider."

"That's a good idea in any case."

"The second is to just wait here quietly until the boys with the strait-jackets show up to take us home."

"And what's the third?"

"The third," Stevens said savagely, "is to take this damned heap out and sink it in the deepest part of the Atlantic Ocean and pretend like it never happened!"

A mechanic stuck his head in the door of the car. "Oh, Dr. Stevens—"

"Get out of here!"

The head hastily withdrew; the voice picked up in aggrieved tones. "Message from the head office."

Stevens got up, went to operator's saddle, cleared the board, then assured himself that the antennæ had ceased their disturbing movements. They had—in fact they appeared so beautifully straight and rigid that he was again tempted to doubt the correctness of his own senses. He climbed out to the floor of the hangar, McLeod behind him. "Sorry to have blasted at you, Whitey," he said to the workman in placating tones. "What is the message?"

"Mr. Gleason would like for you to come into his office as soon as you can."

"I will at once. And Whitey—I've a job for you."

"Yeah?"

"This heap here—seal up its doors and don't let anybody monkey with it. Then have it dragged, dragged mind you, don't try to start it—have it dragged over into the main lab."

"O. K."

Stevens started away; McLeod stopped him. "What do I go home in?"

"Oh, yes, it's your personal property, isn't it? Tell you what, Mac—the company needs it. Make out a purchase order and I'll sign it."

"Weeeell, now—I don't rightly know as I want to sell it. It might be the only job in the country working properly before long."

"Don't be silly. If the others play out, it won't do you any good to have the only one in working order. Power will be shut down."

"I suppose there's that," McLeod conceded. "Still," he said, brightening visibly, "a crate like that, with its special talents, ought to be worth a good deal more than list. You couldn't just go out and buy one."

"Mac," said Stevens, "you've got avarice in your heart and thievery in your fingertips. How much do you want for it?"

"Suppose we say twice the list price, new. That's letting you off easy."

"I happen to know you bought that job at a discount. But go ahead. Either the company can stand it, or it won't make much difference in the bankruptcy."

Gleason looked up as he came in. "Oh, there you are, Jim. You seemed to have pulled a miracle with our friend Waldo the Great. Nice work."

"How much did he stick us for?"

"Just his usual contract. Of course his usual contract is a bit like robbery-with-violence. But it will be worth it if he is successful. And it's on a straight contingent basis. He must feel pretty sure of himself. They say he's never lost a contingent fee in his life. Tell me—what is he like? Did you really get into his house?"

"I did. And I'll tell you about it—sometime. Right now another matter has come up which has me talking to myself. You ought to hear about it, at once."

"So? Go ahead."

Stevens opened his mouth, closed it again, and realized that it had to be seen to be believed. "Say, could you come with me to the main lab? I've got something to show you."

"Certainly."

Gleason was not as perturbed by the squirming metal rods as Stevens had been. He was surprised, but not upset. The truth of the matter is that he lacked the necessary technical background to receive the full emotional impact of the inescapable implications of the phenomenon. "That's pretty unusual, isn't it?" he said quietly.

"Unusual! Look, chief, if the sun rose in the west, what would you think?"

"I think I would call the observatory and ask them why."

"Well, all I can say is that I would a whole lot rather that the sun rose in the west than to have this happen."

"I admit it is pretty disconcerting," Gleason agreed. "I can't say that I've ever seen anything like it. What is Dr. Rambeau's opinion?"

"He hasn't seen it."

"Then perhaps we had better send for him. He may not have gone home for the night as yet."

"Why not show it to Waldo instead?"

"We will. But Dr. Rambeau is entitled to see it first. After all, it's his bailiwick, and I'm afraid the poor fellow's nose is pretty well out of joint as it is. I don't want to go over his head."

Stevens felt a sudden flood of intuition. "Just a second, chief. You're right, but if it's all the same to you I would rather that you showed it to him than for me to do it."

"Why so, Jimmie? You can explain it to him."

"I can't explain a damn thing to him I haven't already told you. And for the next few hours I'm going to be very, very busy indeed."

Gleason looked him over, shrugged his shoulders, and said mildly, "Very well, Jim, if you prefer it that way."

Waldo was quite busy, and therefore happy. He would never have admitted, he did not admit even to himself, that there were certain drawbacks to his self-imposed withdrawal from the world and that chief among these was boredom. He had never had much opportunity to enjoy the time-consuming delights of social intercourse; he honestly believed that the smooth apes had nothing to offer him in the way of companionship. Nevertheless, the pleasures of the solitary intellectual life can pall.

He repeatedly urged Uncle Gus to make his permanent home in Freehold, but he told himself that it was a desire to take care of the old man which motivated him. True—he enjoyed arguing with Grimes, but he was not aware how much those arguments meant to him. The truth of the matter was that Grimes was the only one of the human race who treated him entirely as another human and an equal—and Waldo wallowed in it, completely unconscious that the pleasure he felt in the old man's company was the commonest and most precious of all human pleasures.

But at present he was happy in the only way he knew how to be happy—working.

There were two problems, that of Stevens and

that of Grimes. Required, a single solution which would satisfy each of them. There were three stages to each problem; first, to satisfy himself that the problems really did exist, that the situations were in fact as they had been reported to him verbally; second, to undertake such research as the preliminary data suggested; and third, when he felt that his data was complete, to invent a solution.

"Invent," not "find." Dr. Rambeau might have said "find," or "search for." To Rambeau the universe was an inexorably ordered cosmos, ruled by unvarying law. To Waldo the universe was the enemy, which he strove to force to submit to his will. They might have been speaking of the same thing, but their approaches were different.

There was much to be done. Stevens had supplied him with a mass of data, both on the theoretical nature of the radiated power systems and the deKalb receptors which were the keystone of the system and also on the various cases of erratic performance of which they had lately been guilty. Waldo had not given serious attention to power radiation up to this time, simply because he had not needed to. He found it interesting but comparatively simple. Several improvements suggested themselves to his mind. That standing wave for example, which was the main factor in the co-axial beam—the efficiency of reception could be increased considerably by sending a message back over it which would automatically correct the aiming of the beam. Power delivery to moving vehicles could be made nearly as efficient as the power reception to stationary receivers.

Not that such an idea was important, at present. Later, when he had solved the problem at hand, he intended to make NAPA pay through the nose for the idea—or perhaps it would be more amusing to compete with them. He wondered when their basic patents ran out—must look it up.

Despite inefficiencies the deKalb receptors should work every time, all the time without failure. He went happily about finding out why they did not.

He had suspected some obvious—obvious to *him* —defect in manufacture. But the inoperative deKalbs which Stevens had delivered to him refused to give up their secret. He X-rayed them, measured them with micrometer and interferometer, subjected them to all the usual tests and some that were quite unusual and peculiarly Waldo-ish. They would not perform.

He built a deKalb in his shop, using one of the inoperative ones as a model and using the reworked metal of another of the same design, also inoperative, as the raw material. He used his finest scanners to see with and his smallest waldoes —tiny pixie hands, an inch across—for manipulation in the final stages. He created a deKalb which was as near identical with its model as technology and incredible skill could produce.

It worked beautifully.

Its elder twin still refused to work. He was not discouraged by this. On the contrary, he was elated. He had proved, proved with certainty, that the failure of the deKalbs was not a failure of workmanship, but a basic failure in theory. The problem was real.

Stevens had reported to him the scandalous performance of the deKalbs in McLeod's skycar, but he had not yet given his attention to the matter. Presently, in proper order, when he got around to it, he would look into the matter. In the meantime he tabled the matter. The smooth apes were an hysterical lot—there was probably nothing to the story. Writhing like Medusa's locks, indeed!

He gave fully half his time to Grimes' problem.

He was forced to admit that the biological sciences—if you could call them science!—were more fascinating than he had thought. He had shunned them, more or less; the failure of expensive "experts" to do anything for his condition when he was a child had made him contemptuous of such studies. Old wives' nostrums dressed up in fancy terminology! Grimes he liked and even respected, but Grimes was a special case.

Grimes' data had convinced Waldo that the old man had a case. Why, this was serious! The figures were incomplete, but nevertheless convincing. The curve of the third decrement, extropolated not too unreasonably, indicated that in twenty years there would not be a man left with strength enough to work in the heavy industries. Button pushing would be all they would be good for.

It did not occur to him that all he was good for was button pushing; he regarded weakness in the smooth apes as an old-style farmer might regard weakness in a draft animal. The farmer did not expect to pull the plow—that was the horse's job.

Grimes' medical colleagues must be utter fools.

Nevertheless, he sent for the best physiologists, neurologists, brain surgeons, and anatomists he could locate, ordering them as one might order goods from a catalogue. He must understand this matter.

He was considerably annoyed when he found that he could not make arrangements, by any means, to perform vivisection on human beings. He was convinced by this time that the damage done by ultra short-wave radiation was damage to the neurological system and that the whole matter should be treated from the standpoint of electromagnetic theory. He wanted to perform certain delicate manipulations in which human beings would be hooked up directly to apparatus of his own design to find out in what manner nerve

impulses differed from electrical current. He felt that if he could disconnect portions of a man's nervous circuit, replace it in part with electrical hookups, and examine the whole matter *in situ*, he might make illuminating discoveries. True, the man might not be much use to himself afterward.

But the authorities were stuffy about it; he was forced to content himself with cadavers and with animals.

Nevertheless, he made progress. Extreme short-wave radiation had a definite effect on the nervous system. A double effect; it produced "ghost" pulsations in the neurons, insufficient to accomplish muscular motor response, but, he suspected, strong enough to keep the body in a continual state of inhibited nervous excitation, and secondly, a living specimen which had been subjected to this process for any length of time showed a definite, small but measurable, lowering in the efficiency of its neural impulses. If it had been an electrical circuit, he would have described the second effect as a decrease in insulating efficiency.

The sum of these two effects on the subject individual was a condition of mild tiredness, somewhat similar to the *malaise* of the early stages of pulmonary tuberculosis. The victim did not feel sick; he simply lacked pep. Strenuous bodily activity was not impossible; it was simply distasteful, it required too much effort, too much will power.

But an orthodox pathologist would have been forced to report that the victim was in perfect health—a little rundown, perhaps, but nothing wrong with him. Too sedentary a life, probably—what he needed was fresh air, sunshine, and healthy exercise.

Doc Grimes alone had guessed that the present, general, marked preference for a sedentary life was the effect and not the cause of the prevailing lack of vigor. The change had been slow, at least as slow as the increase in radiation in the air. The individuals concerned had noticed it, if at all, simply as an indication that they were growing a little bit older, "slowing down, not so young as I used to be." And they were content to slow down; it was more comfortable than exertion.

Grimes had first begun to be concerned about it when he began to notice that *all* of his younger patients were "the bookish type." It was all very well for a kid to like to read books, he felt, but a normal boy ought to be out doing a little hell raising, too. What had become of the sand-lot football games, the games of scrub, the clothes-tearing activity that had characterized his own boyhood?

Damn it, a kid ought not to spend *all* his time poring over a stamp collection.

Waldo was beginning to find the answer.

The nerve network of the body was not dissimilar to antennæ. Like antennæ, it could and did pick up electromagnetic waves. But the pickup was evidenced not as induced electrical current, but as nerve pulsation—impulses which were maddeningly similar to, but distinctly different from, electrical current. Electromotive force could be used in place of nerve impulses to activate muscle tissue, but e.m.f. was *not* nerve impulse. For one thing they traveled at vastly different rates of speed. Electrical current travels at a speed approaching that of light; neural impulse is measured in feet per second.

Waldo felt that somewhere in this matter of speed lay the key to the problem.

He was not permitted to ignore the matter of McLeod's fantastic skycar as long as he had intended to. Dr. Rambeau called him up. Waldo accepted the call, since it was routed from the laboratories of NAPA. "Who are you and what do you want?" he demanded of the image.

Rambeau looked around cautiously. *"Sssh!* Not so loud," he whispered. "They might be listening."

"Who might be? And who are you?"

"'They' are the ones who are doing it. Lock your doors at night. I'm Dr. Rambeau."

"Dr. Rambeau? Oh, yes. Well, doctor, what is the meaning of this intrusion?"

The doctor leaned forward until he appeared about to fall out of the stereo picture. "I've learned how to do it," he said tensely.

"How to do what?"

"Make the deKalbs work. The dear, dear deKalbs." He suddenly thrust his hands at Waldo, while clutching frantically with his fingers. "They go like this: *Wiggle, wiggle, wiggle!*"

Waldo felt a normal impulse to cut the man off, but it was overruled by a fascination as to what he would say next. Rambeau continued, "Do you know why? Do you? Riddle me that."

"Why?"

Rambeau placed a finger beside his nose and smiled roguishly. "Wouldn't you like to know? Wouldn't you give a pretty to know? *But I'll tell you!*"

"Tell me, then."

Rambeau looked suddenly terrified. "Perhaps I shouldn't. Perhaps they are listening. But I will, I will! Listen carefully: Nothing is certain."

"Is that all?" inquired Waldo, now definitely amused by the man's antics.

"'Is that all?' Isn't that enough? Hens will crow and cocks will lay. You are here and I am there. Or maybe not. Nothing is certain. Nothing, *nothing*, NOTHING is certain! Around and around the little ball goes, and where it stops nobody knows. Only I've learned how to do it."

"How to do what?"

"How to make the little ball stop where I want it to. Look." He whipped out a penknife. "When you cut yourself, you bleed. Don't you? Or do you?" He sliced at the forefinger of his left hand. "See?" He held the finger close to the pickup; the cut, though deep, was barely discernible and it was bleeding not at all.

Capital! thought Waldo. Hysteric vascular control—a perfect clinical case. "Anybody can do that," he said aloud. "Show me a hard one."

"Anybody? Certainly, anybody can—if they know how. Try this one." He jabbed the point of the penknife straight into the palm of his left hand, so that it stuck out the back of his hand. He wiggled the blade in the wound, withdrew it, and displayed the palm. No blood, and the incision was closing rapidly. "Do you know why? The knife is only probably there, *and I've found the improbability!*"

Amusing as it had been, Waldo was beginning to be bored by it. "Is that all?"

"There is no end to it," pronounced Rambeau, "for nothing is certain any more. Watch this." He held the knife flat on his palm, then turned his hand over.

The knife did not fall, but remained in contact with the underside of his hand.

Waldo was suddenly attentive. It might be a trick; it probably was a trick—but it impressed him more, much more, than Rambeau's failure to bleed when cut. One was common to certain types of psychosis; the other should not have happened. He cut in another viewphone circuit. "Get me Chief Engineer Stevens at North American Power-Air," he said sharply. "At once!"

Rambeau paid no attention, but continued to speak of the penknife. "It does not know which way is down," he crooned, "for nothing is certain any more. Maybe it will fall—maybe not. I think it will. There—it has. Would you like to see me walk on the ceiling?"

"You called me, Mr. Jones?" It was Stevens.

Waldo cut his audio circuit to Rambeau. "Yes. That jumping jack, Rambeau. Catch him and bring him to me, at once. I want to see him."

"But Mr. Jo—"

"Move!" He cut Stevens off, and renewed the audio to Rambeau.

"—uncertainty. Chaos is King, and Magic is loose in the world!" Rambeau looked vaguely at Waldo, brightened, and added, "Good day, Mr. Jones. Thank you for calling."

The screen went dead.

Waldo waited impatiently. The whole thing had been a hoax, he told himself. Rambeau had played a gigantic practical joke. Waldo disliked practical jokes. He put in another call for Stevens and left it in.

When Stevens did call back his hair was mussed and his face was red. "We had a bad time of it," he said.

"Did you get him?"

"Rambeau? Yes, finally."

"Then bring him up."

"To Freehold? But that's impossible. You don't understand. He's blown his top, he's crazy. They've taken him away to a hospital."

"You assume too much," Waldo said icily. "I know he's crazy, but I meant what I said. Arrange it. Provide nurses. Sign affidavits. Use bribery. Bring him to me at once. It is necessary."

"You really mean that?"

"I'm not in the habit of jesting."

"Something to do with your investigations? He's in no shape to be useful to you, I can tell you that."

"That," pronounced Waldo, "is for me to decide."

"Well," said Stevens doubtfully, "I'll try."

"See that you succeed."

Stevens called back thirty minutes later. "I can't bring Rambeau."

"You clumsy incompetent."

Stevens turned red, but held his temper. "Never mind the personalities. He's gone. He never got to the hospital."

"What?",

"That's the crazy part about it. They took him away in a confining stretcher, laced up like a corset. I saw them fasten him in myself. But when they got there he was gone. And the attendants claim *the straps weren't even unbuckled.*"

Waldo started to say "Preposterous," thought better of it. Stevens went on.

"But that's not the half of it. I'd sure like to talk to him myself. I've been looking around his lab. You know that set of deKalbs that went nuts—the ones that were hexed?"

"I know to what you refer."

"Rambeau's got a second set to doing the same thing!"

Waldo remained silent for several seconds, then said quietly, "Dr. Stevens—"

"Yes."

"I want to thank you for your efforts. And will you please have both sets of receptors, the two sets that are misbehaving, sent to Freehold at once?"

There was no doubt about it. Once he had seen them with his own eyes, watched the inexplicable squirming of the antennæ, applied such tests as suggested themselves to his mind, Waldo was forced to conclude that he was faced with new phenomena, phenomena for which he did not know the rules.

If there were rules.

For he was honest with himself. If he saw what he thought he saw, then rules were being broken

by the new phenomena, rules which he had considered valid, rules to which he had never previously encountered exceptions. He admitted to himself that the original failures of the deKalbs should have been considered just as overwhelmingly upsetting to physical law as the unique behavior of these two—the difference lay in that one alien phenomenon was spectacular, the other was not.

Quite evidently Dr. Rambeau had found it so; he had been informed that the doctor had been increasingly neurotic from the first instance of erratic performance of the deKalb receptors.

He regretted the loss of Dr. Rambeau. Waldo was more impressed by Rambeau crazy than he had ever been by Rambeau sane. Apparently the man had had some modicum of ability after all; he had found out *something*—more, Waldo admitted, than he himself had been able to find out so far, even though it had driven Rambeau insane.

Waldo had no fear that Rambeau's experience, whatever it had been, could unhinge his own reason. His own self-confidence was, perhaps, fully justified. His own mild paranoid tendency was just sufficient to give him defenses against an unfriendly world. For him it was healthy, a necessary adjustment to an otherwise intolerable situation, no more pathological than a callous, or an acquired immunity.

Otherwise he was probably more able to face disturbing facts with equanimity than ninety-nine percent of his contemporaries. He had been *born* to disaster; he had met it and had overcome it, time and again. The very house which surrounded him was testimony to the calm and fearless fashion in which he had defeated a world to which he was not adapted.

He exhausted, temporarily, the obvious lines of direct research concerning the strangely twisting metal rods. Rambeau was not available for questioning. Very well, there remained one other man who knew more about it than Waldo did. He would seek him out. He called Stevens again.

"Has there been any word of Dr. Rambeau?"

"No word, and no sign. I'm beginning to think the poor old fellow is dead."

"Perhaps. That witch doctor friend of your assistant—was Schneider his name?"

"Gramps Schneider."

"Yes, indeed. Will you please arrange for him to speak with me?"

"By phone, or do you want to see him in person?"

"I would prefer for him to come here, but I understand that he is old and feeble; it may not be feasible for him to leave the ground. If he is knotted up with spacesickness, he will be no use to me."

"I'll see what can be done."

"Very good. Please expedite the matter. And Dr. Stevens—"

"Well?"

"If it should prove necessary to use the phone, arrange to have a portable full-stereo taken to his home. I want the circumstances to be as favorable as possible."

"O. K."

"Imagine that," Stevens added to McLeod when the circuit had been broken, "the Great-I-Am showing consideration for somebody else's convenience."

"The fat boy must be sick," McLeod decided

"Seems likely. This chore is more yours than mine, Mac. Come along with me; we'll take a run over into Pennsylvania."

"How about the plant?"

"Tell Carruthers he's 'It.' If anything blows, we couldn't help it anyway."

Stevens mugged back later in the day. "Mr. Jones—"

"Yes, doctor?"

"What you suggest can't be arranged—"

"You mean that Schneider can't come to Freehold?"

"I mean that and I mean that you can't talk with him on the viewphone."

"I presume that you mean he is dead."

"No, I do not. I mean that he will not talk over the viewphone under any circumstances whatsoever, to you or to anyone. He says that he is sorry not to accommodate you, but that he is opposed to everything of that nature—cameras, cinécams, television, and so forth. He considers them dangerous. I am afraid he is set in his superstition."

"As an ambassador, Dr. Stevens, you leave much to be desired."

Stevens counted up to ten, then said, "I assure you that I have done everything in my power to comply with your wishes. If you are dissatisfied with the quality of my co-operation, I suggest that you speak to Mr. Gleason." He cleared the circuit.

"How would you like to kick him in the teeth?" McLeod said dreamily.

"Mac, you're a mind reader."

Waldo tried again through his own agents, received the same answer. The situation was, to him, almost intolerable; it had been years since he had encountered a man whom he could not buy, bully, nor, in extremity, persuade. Buying had failed—he had realized instinctively that Schneider would be unlikely to be motivated by greed. And how can one bully, or wheedle, a man who cannot be seen to be talked with?

It was a dead end, no way out. Forget it.

Except, of course, for a means best classed as a Fate-Worse-Than-Death.

No. No, not that. Don't think about it. Better

to drop the whole matter, admit that it had him licked and tell Gleason so. It had been seventeen years since he had been at Earth-surface; nothing could induce him to subject his body to the intolerable demands of that terrible field. Nothing!

It might even kill him. He might choke to death, suffocate. No.

He sailed gracefully across his shop, an overpadded Cupid. Give up this freedom, even for a time, for that torturous bondage? Ridiculous! It was not worth it.

Better to ask an acrophobe to climb Half Dome, or demand that a claustrophobe interview a man in the world's deepest mine.

"Uncle Gus?"

"Oh, hello, Waldo. Glad you called."

"Would it be safe for me to come down to Earth?"

"Eh? How's that? Speak up, man, I didn't understand you."

"I said would it hurt me to make a trip down to Earth."

"This hookup," said Grimes, "is terrible. It sounded just like you were saying you wanted to come down to Earth."

"That's what I did say."

"What's the matter, Waldo? Do you feel all right?"

"I feel fine, but I have to see a man at Earth-surface. There isn't any other way for me to talk to him and I've got to talk to him. Would the trip do me any harm?"

"Ought not to, if you're careful. After all, you were born there. Be careful of yourself, though. You've laid a lot of fat around your heart."

"Oh, dear. Do you think it's *dangerous?*"

"No. You're sound enough. Just don't overstrain yourself. And be careful to keep your temper."

"I will. I most certainly will. Uncle Gus?"

"Yes?"

"Will you come along with me and help me see it through?"

"Oh, I don't think that's necessary."

"Please, Uncle Gus. I don't trust anybody else."

"Time you grew up, Waldo. However, I will, this once."

"Now remember," Waldo told the pilot, "the absolute acceleration must never exceed one and one-tenth G's, *even in landing*. I'll be watching the accelograph the whole time."

"I've been driving ambulances," said the pilot, "for twelve years, and I've never given a patient a rough ride yet."

"That's no answer. Understand me? One and one-tenth—and it should not even approach that figure until we are under the stratosphere. Quiet, Baldur! Quit snuffling."

"I get you."

"Be sure that you do. Your bonuses depend on it."

"Maybe you'd like to herd it yourself."

"I don't like your attitude, my man. If I should die in the tank, you would never get another job."

The pilot muttered something.

"What was that?" Waldo demanded sharply.

"Well—I said it might be worth it."

Waldo started to turn red, opened his mouth.

Grimes cut in: "Easy, Waldo! Remember your heart."

"Yes, Uncle Gus."

Grimes snaked his way forward, indicated to the pilot that he wanted him to join him there.

"Don't pay any attention to anything he says," he advised the man quietly, "except what he said about acceleration. He really can't stand much acceleration. He *might* die in the tank."

"I still don't think it would be any loss. But I'll be careful."

"Good."

"I'm ready to enter the tank," Waldo called out. "Will you help me with the straps, Uncle Gus?"

"Be there in a second."

The tank was not a standard deceleration type, but a modification built for this one trip. The tank was roughly the shape of an oversized coffin and was swung in gymbals to keep it always normal to the axis of absolute acceleration. Waldo floated in water—the specific gravity of his fat hulk was low—from which he was separated by the usual flexible, gasketed tarpaulin. Supporting his head and shoulders was a pad shaped to his contour. A mechanical artificial resuscitator was built into the tank, the back pads being under water, the breast pads out of the water but retracted out of the way.

Grimes stood by with neo-adrenalin; a saddle had been provided for him on the left side of the tank. Baldur was strapped to a shelf on the right side of the tank; he acted as a counterweight to Grimes.

Grimes assured himself that all was in readiness, then called out to the pilot, "Start when you're ready."

"O. K." He sealed the access port; the entry tube folded itself back against the threshold flat of Freehold, freeing the ship. Gently, they got underway.

Waldo closed his eyes; a look of seraphic suffering came over his face.

"Uncle Gus—suppose the deKalbs fail?"

"No matter. Ambulances store six times the normal reserve."

"You're *sure?*"

When Baldur began to feel weight, he started to whimper. Grimes spoke to him, he quieted down.

But presently—days later, it seemed to Waldo—as the ship sank farther down into the Earth's gravitational field, the absolute acceleration necessarily increased, although the speed of the ship had not changed materially. The dog felt the weary heaviness creeping over his body. He did not understand it and he liked it even less; it terrified him. He began to howl.

Waldo opened his eyes. "Merciful heavens!" he moaned. "Can't you do something about that? He must be dying."

"I'll see." Grimes undid his safety belt and swung himself across the tank. The shift in weight changed the balance of the load in the gymbals; Waldo was rocked against the side of the tank.

"Oh!" he panted. "Be careful."

"Take it easy." Grimes caressed the dog's head and spoke to him. When he had calmed down, Grimes grabbed a handful of hide between the dog's shoulders, measured his spot, and jabbed in a hypo. He rubbed the area. "There, old fellow! That will make you feel better."

Getting back caused Waldo to be rocked again, but he bore it in martyred silence.

The ambulance made just one jerky maneuver after it entered the atmosphere. Both Waldo and the dog yelped. "Private ship," the pilot yelled back. "Didn't heed my right-of-way lights." He muttered something about "women drivers—"

"It wasn't his fault," Grimes told Waldo. "I saw it."

The pilot set them down, with exquisite gentleness, in a clearing which had been prepared between the highway and Schneider's house. A party of men was waiting for them there; under Grimes' supervision they unslung the tank and carried Waldo out into the open air. The evolution was performed slowly and carefully, but necessarily involved some degree of bumping and uneven movement. Waldo stood it with silent fortitude, but tears leaked out from under his lowered lids.

Once outside he opened his eyes and asked, "Where is Baldur?"

"I unstrapped him," Grimes informed him, "but he did not follow us out."

Waldo called out huskily, "Here, Baldur! Come to me, boy."

Inside the car, the dog heard his boss' voice, raised his head, and gave a low bark. He still felt that terrifying sickness, but he inched forward on his belly, attempting to comply. Grimes reached the door in time to see what happened.

The dog reached the edge of his shelf and made a grotesque attempt to launch himself in the direction from which he had heard Waldo's voice. He tried the only method of propulsion he knew; no doubt he expected to sail through the door and arrest his flight against the tank on the ground Instead he fell several feet to the inner floor plates, giving one agonized yelp as he did so, and breaking his fall most clumsily with stiffened forelegs.

He lay sprawled where he had landed, making no noise, but not attempting to move. He was trembling violently.

Grimes came up to him and examined him superficially, enough to assure him that the beast was not really hurt, then returned to the outside. "Baldur's had a little accident," he told Waldo, "he's not hurt, but the poor devil doesn't know how to walk. You had best leave him in the ship."

Waldo shook his head slightly. "I want him with me. Arrange a litter."

Grimes got a couple of the men to help him, obtained a stretcher from the pilot of the ambulance, and undertook to move the dog. One of the men said, "I don't know as I care for this job. That dog looks vicious. Look't those eyes."

"He's not," Grimes assured him. "He's just scared out of his wits. Here—I'll take his head."

"What's the matter with him? Same thing as the fat guy?"

"No, he's perfectly well and strong; he's just never learned to walk. This is his first trip to Earth."

"Well, I'll be a cross-eyed owl!"

"I knew a case like it," volunteered the other. "Dog raised in Lunopolis—first week he was down he wouldn't move, just squatted down, and howled, and made messes on the floor."

"So has this one," the first said darkly.

They placed Baldur alongside Waldo's tub. With great effort Waldo raised himself on one elbow, reached out a hand and placed it on the creature's head. The dog licked it, his trembling almost ceased. "There! There!" Waldo whispered. "It's pretty bad, isn't it? Easy, old friend, take it easy."

Baldur thumped his tail.

It took four men to carry Waldo and two more to handle Baldur. Gramps Schneider was waiting for them at the door of his house. He said nothing as they approached, but indicated that they were to carry Waldo inside. The men with the dog hesitated. "Him, too," he said.

When the others had withdrawn—even Grimes returned to the neighborhood of the ship—Schneider spoke again. "Welcome, Mr. Waldo Jones."

"I thank you for your welcome, Grandfather Schneider."

The old man nodded graciously without speaking. He went to the side of Baldur's litter. Waldo felt impelled to warn him that the beast was dangerous with strangers, but some odd restraint—perhaps the effect of that enervating gravitational

field—kept him from speaking in time. Then he saw that he need not bother.

Baldur had ceased his low whimpering, had raised his head, and was licking Gramps Schneider's chin. His tail thumped cheerfully. Waldo felt a sudden tug of jealousy—the dog had never been known to accept a stranger without Waldo's specific injunction. This was disloyalty—treason! But he suppressed the twinge and coolly assessed the incident as a tactical advantage to him.

Schneider pushed the dog's face out of the way and went over him thoroughly, prodding, thumping, extending his limbs. He grasped Baldur's muzzle, pushed back his lips, and eyed his gums. He peeled back the dog's eyelids. He then dropped the matter and came to Waldo's side. "The dog is not sick," he said, "his mind confuses. What made it?"

Waldo told him about Baldur's unusual background. Schneider nodded acceptance of the matter—Waldo could not tell whether he had understood or not—and turned his attention to Waldo. "It is not good for a sprottly lad to lie abed. The weakness—how long has it had you?"

"All my life, grandfather."

"That is not good." Schneider went over him as he had gone over Baldur. Waldo, whose feeling for personal privacy was much more intense than that of the ordinarily sensitive man, endured it for pragmatic reasons. It was going to be necessary, he felt, to wheedle and cajole this strange old creature. It would not do to antagonize him.

To divert his own attention from the indignity he chose to submit to, and to gain further knowledge of the old quack, Waldo let his eyes rove the room. The room where they were seemed to be a combination kitchen-living room. It was quite crowded, rather narrow, but fairly long. A fireplace dominated the kitchen end, but it had been bricked up and a hole for the flue pipe of the base-burner had been let into the chimney. The fireplace was lopsided, as an oven had been included in its left side. The corresponding space at the right was occupied by a short counter which supported a tiny sink. The sink was supplied with water by a small hand pump which grew out of the counter.

Schneider, Waldo decided, was either older than he looked, which seemed incredible, or he had acquired his house from someone now long dead.

The living room end was littered and crowded in the fashion which is no fault, but simply unavoidable in constricted quarters. Books filled several cases, were piled on the floor, hung precariously on chairs. An ancient wooden desk, crowded with papers and supporting a long-obsolete mechanical typewriter, filled one corner. Over it, suspended from the wall, was an ornate clock, carved somewhat like a house. Above its face were two little doors; while Waldo looked at it, a tiny wooden bird painted bright red popped out of the left-hand door, whistled *"Th-wu th-woo!"* four times, and popped frantically back into its hole. Immediately thereafter a little gray bird came out of the right-hand door, said *"Cuckoo"* three times in a leisurely manner, and returned to its hole. Waldo decided that he would like to own such a clock; of course its pendulum-and-weight movement would not function in Freehold, but he could easily devise a one-g centrifuge frame to inclose it, wherein it would have a pseudo Earth-surface environment.

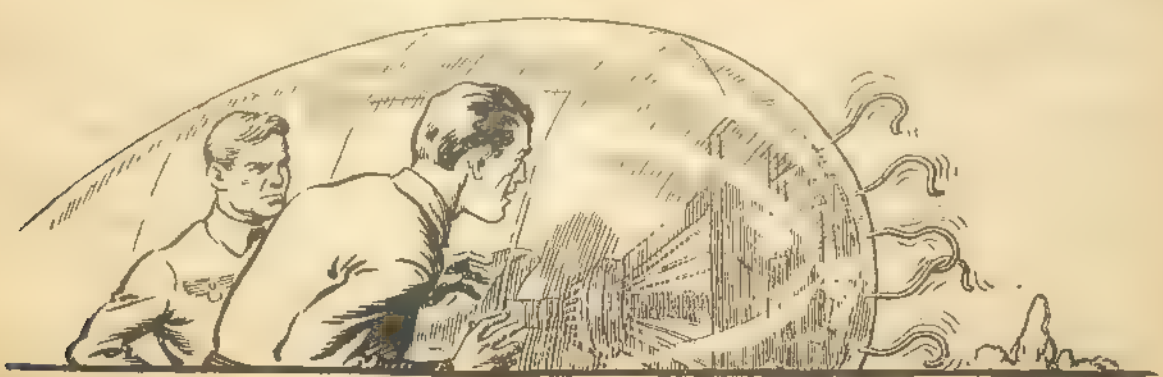
It did not occur to him to fake a pendulum movement by means of a concealed power source; he liked things to work properly.

To the left of the clock was an old-fashioned static calendar, of paper. The date was obscured, but the letters above the calendar proper were large and legible: New York World's Fair—Souvenir of the World of Tomorrow. Waldo's eyes widened a little and went back to something he had noticed before, sticking into a pincushion on the edge of the desk. It was a round plastic button, mounted on a pin whereby it could be affixed to the clothing. It was not far from Waldo's eyes; he could read the lettering on it:

FREE SILVER
SIXTEEN TO ONE

Schneider must be—*old!*

There was a narrow archway, which led into



another room. Waldo could not see into it very well; the arch was draped with a fringe curtain of long strings of large ornamental beads.

The room was rich with odors, many of them old and musty, but not dirty.

Schneider straightened up and looked down at Waldo. "There is nought wrong with your body. Up get yourself and walk."

Waldo shook his head feebly. "I am sorry, grandfather. I cannot."

"You must reach for the power and make it serve you. Try."

"I am sorry. I do not know how."

"That is the only trouble. All matters are doubtful, unless one knows. You spend your force into the Other World. You must reach into the Other World and claim it."

"Where is this 'Other World,' grandfather?"

Schneider seemed a little in doubt as to how to answer this. "The Other World," he said presently, "is the world you do not see. It is here and it is there and it is everywhere. But it is especially *here.*" He touched his forehead. "The mind sits in it and sends its messages through it to the body. Wait." He shuffled away to a little cupboard, from which he removed a small jar. It contained a salve, or unguent, which he rubbed on his hands.

He returned to Waldo and knelt down beside. Grasping one of Waldo's hands in both of his, he began to knead it very gently. "Let the mind be quiet," he directed. "Feel for the power. The Other World is close and full of power. Feel it."

The massage was very pleasant to Waldo's tired muscles. The salve, or the touch of the old man's hand, produced a warm, relaxing tingle. If he were younger, thought Waldo, I would hire him as a masseur. He has a magnetic touch.

Schneider straightened up again and said, "There —that betters you? Now you rest while I some coffee make."

Waldo settled back contentedly. He was very tired, not only was the trip itself a nervous strain, but he was still in the grip of this damnable, thick gravitational field, like a fly trapped in honey. Gramps Schneider's ministrations had left him relaxed and sleepy.

He must have dozed, for the last thing he remembered was seeing Schneider drop an eggshell into the coffeepot. Then the old man was standing before him, holding the pot in one hand and a steaming cup in the other. He set them down, got three pillows which he placed at Waldo's back, then offered him the coffee. Waldo laboriously reached out both hands to take it.

Schneider held it back. "No," he reproved, "one hand makes plenty. Do as I showed. Reach into the Other World for the strength." He took Waldo's right hand and placed it on the handle of the cup, steadying Waldo's hand with his own. With his other hand he stroked Waldo's right arm gently, from shoulder to fingertips. Again the warm tingle.

Waldo was surprised to find himself holding the cup alone. It was a pleasant triumph; at the time he left Earth, seventeen years before, it had been his invariable habit never to attempt to grasp anything with only one hand. In Freehold, of course, he frequently handled small objects one-handed, without the use of waldoes. The years of practice must have improved his control. Excellent!

So, feeling rather cocky, he drank the cup with one hand, using extreme care not to slop it on himself. It was good coffee, too, he was bound to admit, quite as good as the sort he himself made from the most expensive sirup extract—better, perhaps.

When Schneider offered him coffee cake, brown with sugar and cinnamon and freshly rewarmed, he swaggeringly accepted it with his left hand, without asking to be relieved of the cup. He continued to eat and drink, resting and steadying his forearms between bites and sips on the edges of the tank.

The conclusion of the *kaffee klatsch* seemed a good time to broach the matter of the deKalbs. Schneider admitted knowing McLeod and recalled, somewhat vaguely it seemed, the incident in which he had restored to service McLeod's broomstick. "Hugh Donald is a good boy," he said. "Machines I do not like, but it pleasures me to fix things for boys."

"Grandfather," asked Waldo, "will you tell me how you fixed Hugh Donald McLeod's ship?"

"Have you such a ship you wish me to fix?"

"I have many such ships which I have agreed to fix, but I must tell you that I have been unable to do so. I have come to you to find out the right way."

Schneider considered this. "That is difficult. I could show you, but it is not so much what you do as how you think about it. That makes only with practice."

Waldo must have looked puzzled, for the old man looked at him and added, "It is said that there are two ways of looking at everything. That is true and less than true, for there are many ways. Some of them are good ways and some are bad. One of the ancients said that everything either *is*, or *is not*. That is less than true, for a thing can both *be* and *not be*. With practice one can see it both ways. Sometimes a thing which *is* for this world is a thing which *is not* for the Other World. Which is important, since we live in the Other World."

"We live in the Other World?"

"How else could we live? The mind—not the brain, but the mind—is in the Other World, and

reaches this world through the body. That is one true way of looking at it, though there are others."

"Is there more than one way of looking at deKalb receptors?"

"Certainly."

"If I had a set which is not working right brought in here, would you show me how to look at it?"

"It is not needful," said Schneider, "and I do not like for machines to be in my house. I will draw you a picture."

Waldo felt impelled to insist, but he squelched his feeling. "You have come here in humility," he told himself, "asking for instruction. Do not tell the teacher how to teach."

Schneider produced a pencil and a piece of paper, on which he made a careful and very neat sketch of the antennæ sheaf and main axis of a skycar. The sketch was reasonably accurate as well, although it lacked several essential minor details.

"These fingers," Schneider said, "reach deep into the Other World to draw their strength. In turn it passes down this pillar"—he indicated the axis—"to where it is used to move the car."

A fair allegorical explanation, thought Waldo. By considering the "Other World" simply a term for the hypothetical ether, it could be considered correct if not complete. But it told him nothing. "Hugh Donald," Schneider went on, "was tired and fretting. He found one of the bad truths."

"Do you mean," Waldo said slowly, "that McLeod's ship failed because he was worried about it?"

"How else?"

Waldo was not prepared to answer that one. It had become evident that the old man had some quaint superstitions; nevertheless, he might still be able to show Waldo *what* to do, even though Schneider did not know *why*. "And what did you do to change it?"

"I made no change; I looked for the other truth."

"But how? We found some chalk marks—"

"Those? They were but to aid me in concentrating my attention in the proper direction. I drew them down *so*"—he illustrated with pencil on the sketch—"and thought how the fingers reached out for power. And so they did."

"That is all? Nothing more?"

"That is enough."

Either, Waldo considered, the old man did not know how he had accomplished the repair, or he had had nothing to do with it—sheer and amazing coincidence.

He had been resting the empty cup on the rim of his tank, the weight supported by the metal while his fingers merely steadied it. His preoccupation caused him to pay too little heed to it; it slipped from his tired fingers, clattered and crashed to the floor.

He was much chagrined. "Oh, I'm *sorry*, grandfather. I'll send you another."

"No matter. I will mend." Schneider carefully gathered up the pieces and placed them on the desk. "You have tired," he added. "That is not good. It makes you lose what you have gained. Go back now to your house and when you have rested, you can practice reaching for the strength by yourself."

It seemed a good idea to Waldo; he was growing very tired and it was evident that he was to learn nothing specific from the pleasant old fraud. He promised, emphatically and quite insincerely, to practice "reaching for strength," and asked Schneider to do him the favor of summoning his bearers.

The trip back was uneventful. Waldo did not even have the spirit to bicker with the pilot.

Stalemate. Machines that did not work but should, and machines that did work but in an impossible manner. And no one to turn to but one foggy-headed old man. Waldo worked lackadaisically for several days, repeating, for the most part, investigations he had already made rather than admit to himself that he was stuck, that he did not know what to do, that he was in fact whipped and might as well call Gleason and admit it.

The two "bewitched" sets of deKalbs continued to work whenever activated, with the same strange and incredible flexing of each antenna. Other deKalbs which had failed in operation and had been sent to him for investigation still refused to function. Still others, which had not yet failed, performed beautifully without the preposterous fidgeting.

For the umpteenth time he took out the little sketch Schneider had made and examined it. There was, he thought, just one more possibility: To return again to Earth and insist that Schneider actually *do*, in his presence, whatever it was he had done which caused the deKalbs to work. He knew now that he should have insisted on it in the first place, but he had been so utterly played out by having to fight that devilish thick field that he had not had the will to persist.

Perhaps he could have Stevens do it and have the process stereophotoed for a later examination. No, the old man had a superstitious prejudice against artificial images.

He floated gently over to the vicinity of one of the inoperative deKalbs. What Schneider had claimed to have done was preposterously simple. He had drawn chalk marks down each antenna *so*, for the purpose of fixing his attention. Then he had gazed down them and thought about them

"reaching out for power," reaching into the Other World, stretching—

Baldur began to bark frantically.

"Shut up, you fool!" Waldo snapped, without taking his eyes off the antennæ.

Each separate pencil of metal was wiggling, stretching. There was the low, smooth hum of perfect operation.

Waldo was still thinking about it when the televisor demanded his attention. He had never been in any danger of cracking up mentally as Rambeau had done; nevertheless, he had thought about the matter in a fashion which made his head ache. He was still considerably bemused when he cut in his end of the sound-vision circuit. "Yes?"

It was Stevens. "Hello, Mr. Jones. Uh, we wondered . . . that is—"

"Speak up, man!"

"Well, how close are you to a solution?" Stevens blurted out. "Matters are getting pretty urgent."

"In what way?"

"There was a partial breakdown in Great New York last night. Fortunately it was not at peak load and the ground crew were able to install spares before the reserves were exhausted—but you can imagine what it would have been like during the rush hour. In my own department the crashes have doubled in the past few weeks and our underwriters have given notice. We need results pretty quick."

"You'll get your results," Waldo said loftily. "I'm in the final stages of the research." He was actually not that confident, but Stevens irritated him even more than most of the smooth apes.

Doubt and reassurance mingled in Stevens' face. "I don't suppose you would care to give us a hint of the general nature of the solution?"

No, Waldo could not. Still—it would be fun to pull Stevens' leg. "Come close to the pickup, Dr. Stevens. I'll tell you." He leaned forward himself, until they were almost nose to nose—in effect. "Magic is loose in the world!"

He cut the circuit at once.

Down in the underground labyrinth of North American's home plant, Stevens stared at the blank screen. "What's the trouble, chief?" McLeod inquired.

"I don't know. I don't rightly know. But I *think* that Fatty has slipped his cams, just the way Rambeau did."

McLeod grinned delightedly. "How sweet! I always did think he was a hoot owl."

Stevens looked very sober. "You had better pray that he *hasn't* gone nuts. We're depending on him. Now let me see those operation reports."

Magic loose in the world. It was as good an explanation as any, Waldo mused. Causation gone haywire; sacrosanct physical laws no longer operative. Magic. As Gramps Schneider had put it, it seemed to depend on the way one looked at it.

Apparently Schneider had known what he was talking about. Although Schneider naturally had no real grasp of the physical theory involved in the deKalbs.

Wait a minute, now! Wait a minute. He had been going at this problem wrongly perhaps. He had approached it with a certain point of view himself, a point of view which had made him critical of the old man's statements—an assumption that he, Waldo, knew more about the whole matter than Schneider did. To be sure he had gone to see Schneider, but he had thought of him as a back-country hex doctor, a man who might possess one piece of information useful to Waldo, but who was basically ignorant and superstitious.

Suppose he were to review the situation from a different viewpoint. Let it be assumed that everything Schneider had to say was coldly factual and enlightened, rather than allegorical and superstitious—

He settled himself to do a few hours of hard thinking.

In the first place Schneider had used the phrase "the Other World" time and again. What did it mean? Literally? A "world" was a space-time-energy continuum; an "Other World" was, therefore, such a continuum but a different one from the one in which he found himself. Physical theory found nothing repugnant in such a notion; the possibility of infinite numbers of continua was a familiar, orthodox speculation. It was even convenient in certain operations to make such an assumption.

Had Gramps Schneider meant that? A literal, physical "Other World"? On reflection, Waldo was convinced that he must have meant just that, even though he had not used conventional scientific phraseology. "Other World" sounds poetical, but to say an "additional continuum" implies physical meaning. The terms had led him astray.

Schneider had said that the Other World was all around, here, there, and everywhere. Well, was not that a fair description of a space superposed and in one-to-one correspondence? Such a space might be so close to this one that the interval between them was an infinitesimal, yet unnoticed and unreachable, just as two planes may be considered as coextensive and separated by an unimaginably short interval, yet be perfectly discrete, one from the other.

The Other Space was not entirely unreachable; Schneider had spoken of reaching into it. The idea was fantastic, yet he must accept it for the purposes of this investigation. Schneider had

implied . . . no . . . *stated* that it was a matter of mental outlook.

Was that really so fantastic? If a continuum were an unmeasurably short distance away, yet completely beyond one's physical grasp, would it be strange to find that it was most easily reached through some subtle and probably subconscious operation of the brain? The whole matter was subtle—and Heaven knew that no one had any real idea of *how* the brain works. No idea at all—it was laughably insufficient to try to explain the writing of a symphony in terms of the mechanics of colloids. No, nobody knew how the brain works; one more inexplicable ability in the brain was not too much to swallow.

Come to think of it, the whole notion of consciousness and thought was fantastically improbable.

All right—so McLeod disabled his skycar himself by thinking bad thoughts—Schneider fixed it by thinking the correct thoughts. Then what?

He reached a preliminary conclusion almost at once: By extension, the other deKalb failures were probably failures on the part of the operators. The operators were probably rundown, tired out, worried about something, and in some fashion still not clear they infected, or affected, the deKalbs with their own troubles. For convenience, let us say that the deKalbs were short-circuited into the Other World. Poor terminology, but it helped him to form a picture.

Grimes' hypothesis! "Rundown, tired out, worried about something!" Not proved yet—but he felt sure of it. The epidemic of crashes through material was simply an aspect of the general *myasthenia* caused by short-wave radiation.

If that were true—

He cut in a sight-sound circuit to Earth and demanded to talk with Stevens.

"Dr. Stevens," he began at once, "there is a preliminary precautionary measure which should be undertaken right away."

"Yes?"

"First, let me ask you this: Have you had many failures of deKalbs in private ships? What is the ratio?"

"I can't give you exact figures at the moment," Stevens answered, somewhat mystified, "but there have been practically none. It's the commercial lines which have suffered."

"Just as I suspected. A private pilot won't fly unless he feels up to it, but a man with a job goes ahead no matter how he feels. Make arrangements for special physical and psycho examinations for all commercial pilots flying deKalb-type ships. Ground any who are not feeling in tiptop shape. Call Dr. Grimes. He'll tell you what to look for."

"That's a pretty tall order, Mr. Jones. After all, most of those pilots, practically all of them, aren't our employees. We don't have much control over them."

"That's your problem," Waldo shrugged. "I'm trying to tell you how to reduce crashes in the interim before I submit my complete solution."

"But—"

Waldo heard no more of the remark; he had cut off when he himself was through. He was already calling over a permanently energized, leased circuit which kept him in touch with his terrestrial business office—with his "trained seals." He gave them some very odd instructions, orders for books, old books, rare books. Books dealing with magic.

Stevens consulted with Gleason before attempting to do anything about Waldo's difficult request. Gleason was dubious. "He offered no reason for the advice?"

"None. He told me to look up Dr. Grimes and get his advice as to what specifically to look for."

"Dr. Grimes?"

"The M. D. who introduced me to Waldo—mutual friend."

"I recall. Mm-m-m . . . it will be difficult to go about grounding men who don't work for us. Still—I suppose several of our larger customers would co-operate if we asked them to and gave them some sort of a reason. What are you looking so odd about?"

Stevens told him of Waldo's last, inexplicable statement. "Do you suppose it could be affecting him the way it did Dr. Rambeau?"

"Mm-m-m. Could be, I suppose. In which case it would not be well to follow his advice. Have you anything else to suggest?"

"No—frankly."

"Then I see no alternative but to follow his advice. He's our last hope. A forlorn one, perhaps, but our only one."

Stevens brightened a little. "I could talk to Doc Grimes about it. He knows more about Waldo than anyone else."

"You have to consult him anyway, don't you? Very well—do so."

Grimes listened to the story without comment. When Stevens had concluded he said, "Waldo must be referring to the symptoms I have observed with respect to short-wave exposure. That's easy—you can have the proofs of the monograph I've been preparing. It'll tell you all about it."

The information did not reassure Stevens; it helped to confirm his suspicion that Waldo had lost his grip. But he said nothing. Grimes continued, "As for the other, Jim, I can't visualize Waldo losing his mind that way."

"He never did seem very stable to me."

"I know what you mean. But his paranoid streak is no more like what Rambeau succumbed to than chicken pox is like mumps. Matter of fact, one

psychosis protects against the other. But I'll go see."

"You will? Good!"

"Can't go today. Got a broken leg and some children's colds that'll bear watching. Been some polio around. Ought to be able to make it the end of the week though."

"Doc, why don't you give up G. P. work? It must be deadly."

"Used to think so when I was younger. But about forty years ago I quit treating diseases and started treating people. Since then I've enjoyed it."

Waldo indulged in an orgy of reading, gulping the treatises on magic and related subjects as fast as he could. He had never been interested in such subjects before; now, in reading about them with the point of view that there might be, and even probably was, something to be learned, he found them intensely interesting.

There were frequent references to another world—sometimes it was called the Other World, sometimes the Little World. Read with the conviction that the term referred to an actual, material different continuum he could see that many of the practitioners of the forbidden arts had held the same literal viewpoint. They gave directions for using this other world; sometimes the directions were fanciful, sometimes they were baldly practical.

It was fairly evident that at least ninety percent of all magic, probably more, was balderdash and sheer mystification. The mystification extended even to the practitioners, he felt; they had lacked the scientific method; they employed a single-valued logic as faulty as the two-valued logic of the obsolete Spencer determinism; there was no suggestion of modern extensional, many-valued logic.

Nevertheless, the laws of contiguity, of sympathy, and of homeopathy had a sort of twisted rightness to them when considered in relation to the concept of another, different, but accessible, world. A man who had some access to a different space might well believe in a logic in which a thing could *be, not be,* or *be anything* with equal ease.

Despite the nonsense and confusion which characterized the treatments of magic which dated back to the period when the art was in common practice the record of accomplishment of the art was impressive. There was surare, and digitalis, and quinine, hypnotism and telepathy. There was the hydraulic engineering of the Egyptian priests. Chemistry itself was derived from alchemy—for that matter, most modern science owed its origins to the magicians. Science had stripped off the surplusage, run it through the ringer of two-valued logic, and placed the knowledge in a form in which anyone could use it.

Unfortunately, that part of magic which refused to conform to the neat categories of the nineteenth century methodologists was lopped off and left out of the body of science. It fell into disrepute, was forgotten save as fable and superstition.

He began to think of the Arcane arts as aborted sciences, abandoned before they had been clarified.

And yet the manifestations of the sort of uncertainty which had characterized some aspects of magic and which he now attributed to an hypothetical additional continua had occurred frequently, even in modern times. The evidence was overwhelming to anyone who approached it with an *open mind.*

Poltergeisten, stones falling from the sky, apportation, "bewitched" persons—or, as he thought of them, persons who for some undetermined reason were loci of uncertainty—"haunted" houses, strange fires of the sort that would have once been attributed to salamanders. There were hundreds of such cases, carefully recorded and well vouched for, but ignored by orthodox science as being impossible. They *were* impossible, by known law, but considered from the standpoint of a coextensive additional continuum, they became entirely credible.

He cautioned himself not to consider his tentative hypothesis of the Other World as proved; nevertheless, it was an adequate hypothesis even if it should develop that it did not apply to some of the cases of strange events.

The Other Space might have different physical laws—no reason why it should not. Nevertheless, he decided to proceed on the assumption that it was much like the space he knew.

The Other World might even be inhabited—that was an intriguing thought! In which case anything could happen through "magic." Anything!

Time to stop speculating and get down to a little solid research. He had previously regretfully given up trying to apply the formulæ of the medieval magicians. It appeared that they never wrote down *all* of a procedure; some essential—so the reports ran and so his experience confirmed—was handed down verbally from master to student. His experience with Schneider confirmed this; there were things, *attitudes,* which must needs be taught directly.

He regretfully set out to learn what he must unassisted.

"Gosh, Uncle Gus, I'm glad to see you!"

"Decided I'd better look in on you. You haven't phoned me in weeks."

"That's true—but I've been working awfully hard, Uncle Gus."

"Too hard, maybe. Mustn't overdo it. Lemme see your tongue."

"I'm O. K." But Waldo stuck out his tongue,

just the same; Grimes looked at it and felt his pulse.

"You seem to be ticking all right. Learning anything?"

"Quite a lot. I've about got the matter of the deKalbs whipped."

"That's good. The message you sent Stevens seemed to indicate that you had found some hookup that could be used on my pet problem, too."

"In a way, yes, but around from the other end. It begins to seem as if it was your problem which created Stevens' problem."

"Huh?"

"I mean it. The symptoms caused by ultra short-wave radiation may have had a lot to do with the erratic behavior of the deKalbs."

"How?"

"I don't know myself. But I've rigged up a working hypothesis and I'm checking it."

"Hm-m-m—want to talk about it?"

"Certainly—to you." Waldo launched into an account of his interview with Schneider, concerning which he had not previously spoken to Grimes, even though Grimes had made the trip with him. He never, as Grimes knew, discussed anything until he was ready to.

The story of the third set of deKalbs to be infected with the incredible writhings caused Grimes to raise his eyebrows. "Mean to say you caught on to how to do *that?*"

"Yes, indeed. Not *'how,'* maybe, but I can do it. I've done it more than once. I'll show you." He drifted away toward one side of the great room where several sets of deKalbs, large and small, were mounted, with their controls, on temporary guys. "This fellow over on the end, it just came in today. Broke down. I'll give it Gramps Schneider's hocus-pocus and fix it. Wait a minute—I forgot to turn on the power."

He returned to the central ring which constituted his usual locus and switched on the beam-caster. Since the ship itself effectively shielded anything in the room from outer radiation, he had installed a small power plant and caster similar in type to NAPA's giant ones; without it he would have had no way to test the reception of the deKalbs.

He rejoined Grimes and passed down the line of deKalbs, switching on the activizing circuits. All save two began to display the uncouth motions he had begun to think of as the Schneider flex. "That one on the far end," he remarked, "is in operation but doesn't flex. It has never broken down, so it's never been treated. It's my control; but this one"—he touched the one in front of him—"needs fixing. Watch me."

"What are you going to do?"

"To tell the truth, I don't quite know. But I'll do it." He did not know. All he knew was that it was necessary to gaze down the antennæ, think about them reaching into the Other World, think of them reaching for power, reaching—

The antennæ began to squirm.

"That's all there is to it—strictly between ourselves. I learned it from Schneider." They had returned to the center of the sphere, at Grimes' suggestion, on the pretext of wanting to get a cigarette—the squirming deKalbs made him nervous, but he did not want to say so.

"How do you explain it?"

"I regard it as an imperfectly understood phenomenon of the Other Space. I know less about it than Franklin knew about lightning. But I will know—I will! I could give Stevens a solution right now for his worries if I knew some way to get around your problem, too."

"I don't see the connection."

"There ought to be some way to do the whole thing through the Other Space. Start out by radiating power into the Other Space and pick it up from there. Then the radiation could not harm human beings. It would never get at them; it would duck around them. I've been working on my caster, but with no luck so far. I'll crack it in time."

"I hope you do. Speaking of that, isn't the radiation from your own caster loose in this room?"

"Yes."

"Then I'll put on my shield coat. It's not good for you, either."

"Never mind. I'll turn it off." As he turned to do so there was the sound of a sweet, chirruping whistle. Baldur barked. Grimes turned to see what caused it.

"What," he demanded, "have you got there?"

"Huh? Oh, that's my cuckoo clock. Fun, isn't it?" Grimes agreed that it was, although he could not see much use for it. Waldo had mounted it on the edge of a light metal hoop which spun with a speed just sufficient to produce a centrifugal force of one g.

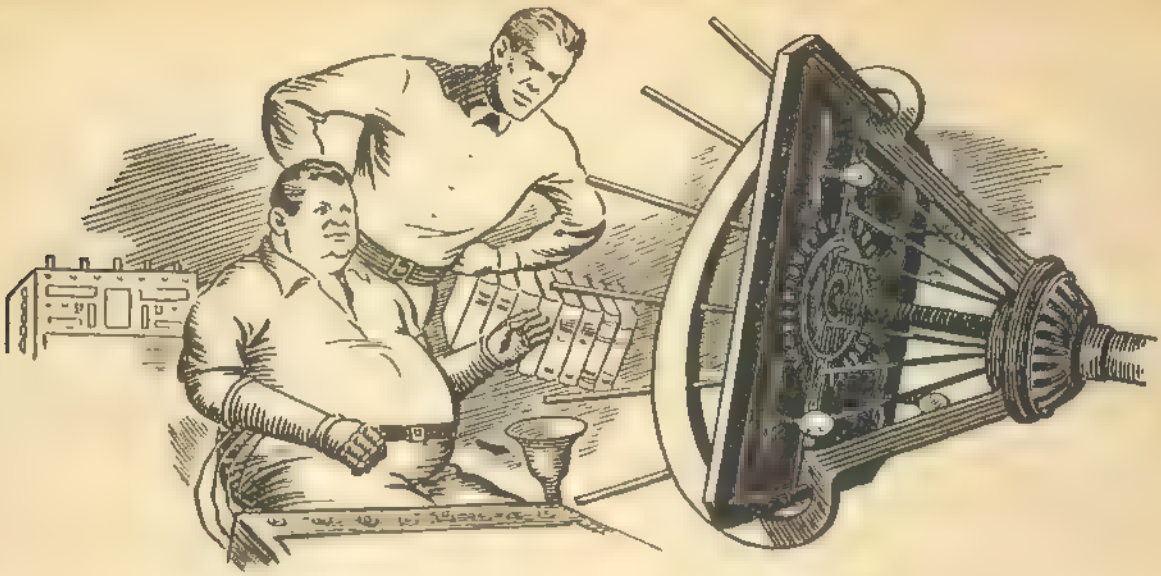
"I rigged it up," Waldo continued, "while I was bogged down in this problem of the Other Space. Gave me something to do."

"This 'Other Space' business—I still don't get it."

"Think of another continuum much like our own and superposed on it the way you might lay one sheet of paper on another. The two spaces aren't identical, but they are separated from each other by the smallest interval you can imagine—coextensive but not touching—usually. There is an absolute one-to-one, point-for-point correspondence, as I conceive it, between the two spaces, but they are not necessarily the same size or shape."

"Hey? Come again—they would *have* to be."

"Not at all. Which has the larger number of



points in it? A line an inch long, or a line a mile long?"

"A mile long, of course."

"No. They have exactly the same number of points. Want me to prove it?"

"I'll take your word for it. But I never studied that sort of math."

"All right. Take my word for it then—neither size nor shape are any impediment to setting up a full, point-for-point correspondence between two spaces. Neither of the words are really appropriate. 'Size' has to do with a space's own inner structure, its dimensions in terms of its own unique constants. 'Shape' is a matter which happens inside itself—or at least not inside *our* space—and has to do with how it is curved, open or closed, expanding or contracting."

Grimes shrugged. "It all sounds like gibberish to me." He returned to watching the cuckoo clock swing round and round its wheel.

"Sure it does," Waldo assented cheerfully. "We are limited by our experience. Do you know how I think of the other world?" The question was purely rhetorical. "I think of it as about the size and shape of an ostrich egg, but nevertheless a whole universe, existing side by side with our own, from here to the farthest star. I know that it's a false picture, but it helps me to think about it that way."

"I wouldn't know," said Grimes, and turned himself around in the air. The compound motion of the clock's pendulum was making him a little dizzy. "Say! I thought you turned off the caster?"

"I did," Waldo agreed, and looked where Grimes was looking. The deKalbs were still squirming. "I thought I did," he said doubtfully, and turned to the caster's control board. His eyes then opened wider. "But I *did*. It *is* turned off."

"Then what the devil—"

"*Shut up!*" He had to think—think hard. Was the caster actually out of operation? He floated himself over to it, inspected it. Yes, it was dead, dead as the dinosaurs. Just to make sure he went back, assumed his primary waldoes, cut in the necessary circuits, and partially disassembled it. But the deKalbs still squirmed.

The one deKalb set which had not been subjected to the Schneider treatment was dead; it gave out no power hum. But the others were working frantically, gathering power from—*where?*

He wondered whether or not McLeod had said anything to Gramps Schneider about the casters from which the deKalbs were intended to pick up their power. Certainly he himself had not. It simply had not come into the conversation. But Schneider had said something. "The Other World is close by and full of Power!"

In spite of his own intention of taking the old man literally he had ignored that statement. The Other World is full of Power. "I am sorry I snapped at you, Uncle Gus," he said.

"'S all right."

"But what do you make of that?"

"Looks like you've invented perpetual motion, son."

"In a way, perhaps. Or maybe we've repealed the law of conservation of energy. Those deKalbs are drawing energy that was never before in this world!"

"Hm-m-m!"

To check his belief he returned to the control ring, donned his waldoes, cut in a mobile scanner, and proceeded to search the space around the deKalbs with the most sensitive pickup for the radio power band he had available. The needles never jumped; the room was dead in the wave lengths to which the deKalbs were sensitive. The power came from Other Space.

The power came from Other Space. Not from his own beamcaster, not from NAPA's shiny stations, but from Other Space. In that case he was not even close to solving the problem of the defective deKalbs—he might never solve it. Wait now—just what had he contracted to do? He tried to recall the exact words of the contract.

There just might be a way around it. Maybe. Yes, and this newest cockeyed trick of Gramps Schneider's little pets could have some very tricky aspects. He began to see some possibilities—but he needed to think about it.

"Uncle Gus—"

"Yes, Waldo?"

"You can go back and tell Stevens that I'll be ready with the answers. We'll get his problem licked and yours, too. In the meantime I've got to do some really heavy thinking—so I want to be by myself, please."

"Greetings, Mr. Gleason. *Quiet, Baldur!* Come in. Be comfortable. How do you do, Dr. Stevens."

"How do you do, Mr. Jones."

"This," said Gleason, indicating a figure trailing him, "is Mr. Harkness, head of our legal staff."

"Ah, yes, indeed. There will be matters of contract to be discussed. Welcome to Freehold, Mr. Harkness."

"Thank you," Harkness said coldly. "Will your attorneys be present?"

"They are present." Waldo indicated a stereo screen. Two figures showed in it; they bowed and murmured polite forms.

"This is most irregular," Harkness complained. "Witnesses should be present in person. Things seen and heard by television are not evidence."

Waldo drew his lips back. "Do you wish to make an issue of it?"

"Not at all," Gleason said hastily. "Never mind, Charles." Harkness subsided.

"I won't waste your time, gentlemen," Waldo began. "We are here in order that I may fulfill my contract with you. The terms are known—we will pass over them." He inserted his arms into his primary waldoes. "Lined up along the far wall you will see a number of radiant power receptors, commonly called deKalbs. Dr. Stevens may, if he wishes, check their serial numbers—"

"No need to."

"Very well. I shall start my local beamcaster, in order that we may check the efficiency of their operation." His waldoes were busy as he spoke. "Then I shall activate the receptors, one at a time." His hands pawed the air; a little pair of secondaries switched on the proper switches on the control board of the last set in line. "This is an ordinary type, supplied to me by Dr. Stevens, which has never failed in operation. You may assure yourself that it is now operating in the normal manner, if you wish, doctor."

"I can see that it is."

"We will call such a receptor a 'deKalb' and its operation 'normal.'" The small waldoes were busy again. "Here we have a receptor which I choose to term a 'Schneider-deKalb' because of certain treatment it has received"—the antennæ began to move—"and its operation 'Schneider-type' operation. Will you check it, doctor?"

"O. K."

"You fetched with you a receptor set which has failed?"

"As you can see."

"Have you been able to make it function?"

"No, I have not."

"Are you sure? Have you examined it carefully?"

"Quite carefully," Stevens acknowledged sourly. He was beginning to be tired of Waldo's pompous flubdubbery.

"Very well. I will now proceed to make it operative." Waldo left his control ring, shoved himself over to the vicinity of the defective deKalb, and placed himself so that his body covered his exact actions from the sight of the others. He returned to the ring and, using waldoes, switched on the activating circuit of the deKalb.

It immediately exhibited Schneider-type activity.

"That is my case, gentlemen," he announced. "I have found out how to repair deKalbs which become spontaneously inoperative. I will undertake to apply the Schneider treatment to any receptors which you may bring to me. That is included in my fee. I will undertake to train others in how to apply the Schneider treatment. That is included in my fee—but I cannot guarantee that any particular man will profit by my instruction. Without going into technical details I may say that the treatment is very difficult, much harder than it looks. I think that Dr. Stevens will confirm that." He smiled thinly. "I believe that completes my agreement with you."

"Just a moment, Mr. Jones," put in Gleason. "Is a deKalb foolproof, once it has received the Schneider treatment?"

"Quite. I guarantee it."

They went into a huddle while Waldo waited. At last Gleason spoke for them, "These are not quite the results we had expected, Mr. Jones, but we agree that you have fulfilled your commission—with the understanding that you will Schneider-treat any receptors brought to you and instruct others, according to their ability to learn."

"That is correct."

"Your fee will be deposited to your account at once."

"Good. That is fully understood and agreed? I have completely and successfully performed your commission?"

"Correct."

"Very well, then. I have one more thing to show you. If you will be patient—" A section of the wall folded back; gigantic waldoes reached into the room beyond and drew forth a large apparatus, which resembled somewhat in general form an ordinary set of deKalbs but which was considerably more complicated. Most of the complications were sheer decoration, but it would have taken a skilled engineer a long time to prove the fact.

The machine did contain one novel feature; a built-in meter of a novel type, whereby it could be set to operate for a predetermined time and then destroy itself and a radio control whereby the time limit could be varied. Furthermore, the meter would destroy itself and the receptors if tampered with by any person not familiar with its design. It was Waldo's tentative answer to the problem of selling free and unlimited power.

But of these matters he said nothing. Small waldoes had been busy attaching guys to the apparatus; when they were through he said, "This, gentlemen, is an instrument which I choose to call a Jones-Schneider-deKalb. And it is the reason why you will not be in the business of selling power much longer."

"So?" said Gleason. "May I ask why?"

"Because," he was told, "I can sell it more cheaply and conveniently and under circumstances you cannot hope to match."

"That is a strong statement."

"I will demonstrate. Dr. Stevens, you have noted that the other receptors are operating. I will turn them off." The waldoes did so. "I will now stop the beamcast and I will ask you to assure yourself, by means of your own instruments, that there is *no* radiant power, other than ordinary visible light, in this room."

Somewhat sullenly, Stevens did so. "The place is dead," he announced some minutes later.

"Good. Keep your instruments in place, that you may be sure it remains dead. I will now activate my receptor." Little mechanical hands closed the switches. "Observe it, doctor. Go over it thoroughly."

Stevens did so. He did not trust the readings shown by its instrument board; he attached his own meters in parallel. "How about it, James?" Gleason whispered.

Stevens looked disgusted. "The damn thing draws power from nowhere!"

They all looked at Waldo. "Take plenty of time, gentlemen," he said grandly. "Talk it over."

They withdrew as far away as the room permitted and whispered. Waldo could see that Harkness and Stevens were arguing, that Stevens was noncommittal. That suited him. He was hoping that Stevens would not decide to take another look at the fancy gadget he had termed a Jones-Schneider-deKalb. Stevens must not learn too much about it—yet. He had been careful to say nothing but the truth about it, but perhaps he had not said all of the truth—he had not mentioned that *all* Schneider-treated deKalbs were sources of free power.

Rather embarrassing if Stevens should discover that!

The meter-and-destruction device Waldo had purposely made mysterious and complex, but it was not useless. Later, he would be able to point out, quite correctly, that without such a device NAPA simply could not remain in business.

Waldo was not easy. The whole business was a risky gamble; he would have much preferred to know more about the phenomena he was trying to peddle, but—he shrugged mentally while preserving a smile of smug confidence—the business had dragged on several months already and the power situation really was critical. This solution would do—if he could get their names on the dotted line quickly enough.

For he had no intention of trying to compete with NAPA.

Gleason pulled himself away from Stevens and Harkness, came to Waldo. "Mr. Jones, can't we arrange this amicably?"

"What have you to suggest?"

It was quite an hour later that Waldo, with a sigh of relief, watched his guests' ship depart from the threshold flat. A fine caper, he thought, and it had worked—he had gotten away with it. He had magnanimously allowed himself to be persuaded to consolidate, provided—he had allowed himself to be quite temperamental about this—the contract were concluded at once, no fussing around and fencing between lawyers. Now or never—put up or shut up. The proposed contract he had pointed out virtuously gave him nothing at all unless his allegations about the Jones-Schneider-deKalb were correct.

Gleason considered this point and had decided to sign, had signed.

Even then Harkness had attempted to claim that Waldo had been an employee of NAPA. Waldo had written that first contract himself—a specific commission for a contingent fee. Harkness did not have a leg to stand on—even Gleason had agreed to that.

In exchange for all rights to the Jones-Schneider-deKalb, for which he agreed to supply drawings—wait till Stevens saw, and understood, those sketches!—for that he had received the promise of senior stock in NAPA, nonvoting, but fully paid up and nonassessable. The lack of active participation in the company had been his own idea—there were going to be more headaches in the power business, headaches aplenty. He could see them coming—bootleg designs, means of outwitting the metering, lots of things. Free power

had come and efforts to stop it would in the long run, he believed, be fruitless.

Waldo laughed so hard that he frightened Baldur, who set up an excited barking.

He could afford to forget Hathaway now.

His revenge on NAPA contained one potential flaw; he had assured Gleason that the Schneider-treated deKalbs would continue to operate, would not come unstuck. He believed that to be true simply because he had faith in Gramps Schneider. But he was not prepared to prove it. He knew himself that he did not know enough about the phenomena associated with the Other World to be sure that something would, or would not, happen. It was still going to be necessary to do some hard, extensive research.

But the Other World was a devilishly difficult place to investigate!

Suppose, he speculated, that the human race was blind, had never developed eyes. No matter how civilized, enlightened and scientific the race might have become it is difficult to see how such a race could ever have developed the concepts of astronomy. The Sun they might know of as a cyclic source of energy having a changing, directional character, for the Sun is so overpowering that it may be "seen" with the skin. They would notice it and invent instruments to trap it and examine it.

But the pale stars—would they ever notice them? It seemed most unlikely. The very notion of the celestial universe, its silent depths and starlit grandeur, would be beyond them. Even if one of their scientists should have the concept forced on him in such a manner that he was obliged to accept the fantastic, incredible thesis as fact, how then would he go about investigating its details?

Waldo tried to imagine an astronomical phototelescope, conceived and designed by a blind man, intended to be operated by a blind man, and capable of collecting data which could be interpreted by a blind man. He gave it up; there were too many hazards. It would take a subtlety of genius far beyond his own to deal with the inescapably torturous concatenations of inferential reasoning necessary to the solution of such a problem. It would strain him to invent such instruments *for* a blind man; he did not see how a blind man could ever overcome the difficulties unassisted.

In a way that was what Schneider had done for him; alone, he would have bogged down.

But even with Schneider's hints the problem of investigating the Other World was still much like the dilemma of the blind astronomer. He could not *see* the Other World; only through the Schneider treatment had he been able to contact it. Damnation! how could he design instruments to study it?

He suspected that he would eventually have to go back to Schneider for further instruction, but that was an expedient so distasteful that he refused to think much about it. Furthermore, Gramps Schneider might not be able to teach him much—they did not speak the same language.

This much he did know: The Other Space was there and it could be reached sometimes by proper orientation of the mind, deliberately as Schneider had taught him, or subconsciously as had happened to McLeod and others.

He found the idea distasteful. That thought and thought alone should be able to influence physical phenomena was contrary to the whole materialistic philosophy in which he had grown up. He had a prejudice in favor of order and invariable natural laws. His cultural predecessors, the experimental philosophers who had built up the world of science and its concomitant technology, Galileo, Newton, Edison, Einstein, Steinmetz, Jeans, and their myriad colleagues—these men had thought of the physical universe as a mechanism proceeding by inexorable necessity. Any apparent failure to proceed thus was regarded as an error in observation, an insufficient formulation of hypothesis, or an insufficiency of datum.

Even the short reign of the Heisenberg uncertainty principle had not changed the fundamental orientation toward Order and Cosmos—the Heisenberg uncertainty was one they were certain of! It could be formulated, expressed, and a rigorous statistical mechanics could be built from it. In 1950 Horowitz's reformulation of wave mechanics had eliminated the concept. Order and causation.

But this damned business!—one might as well pray for rain, wish on the Moon, go to faith healers, surrender whole hog to Bishop Berkeley's sweetly cerebral world-in-your-head. "—the tree's not a tree, when there's no one about on the quod!"

Waldo was not emotionally wedded to Absolute Order as Rambeau had been; he was in no danger of becoming mentally unbalanced through a failure of his basic conceptions—nevertheless, consarn it, it was convenient for things to work the way one expected them to. On order and natural law was based predictability; without predictability it was impossible to live. Clocks should run evenly; water should boil when heat is applied to it; food should nourish, not poison; deKalb receptors should *work*, work the way they were designed to—Chaos was insupportable, it could not be lived with.

Suppose Chaos *were* king and the order we thought we detected in the world about us a mere phantasm of the imagination; where would that lead us? In that case, Waldo decided, it was

entirely possible that a ten-pound weight *did* fall ten times as fast as a one-pound weight until the day the audacious Galileo decided in his mind that it was not so. Perhaps the whole meticulous science of ballistics derived from the convictions of a few firm-minded individuals who had sold the notion to the world. Perhaps the very stars were held firm in their courses by the unvarying faith of the astronomers. Orderly Cosmos, created out of Chaos—by Mind!

The world was flat before geographers decided to think of it otherwise. The world was flat and the Sun, tub size, rose in the east and set in the west. The stars were little lights, studding a pellucid dome which barely cleared the tallest mountains. Storms were the wrath of gods and had nothing to do with the calculus of air masses. A Mind-created animism dominated the world—then.

More recently it had been different. A prevalent convention of materialistic and invariable causation had ruled the world; on it was based the whole involved technology of a machine-served civilization. The machines *worked*, the way they were designed to work, because everybody believed in them.

Until a few pilots, somewhat debilitated by overmuch exposure to radiation, had lost their confidence and infected their machines with uncertainty—and thereby let magic loose in the world.

He was beginning, he thought, to understand what had happened to magic. Magic was the erratic law of an animistic world; it had been steadily pushed back by the advancing philosophy of invariant causation. It was gone now—until this new outbreak—and its world with it, except for back waters of "superstition." Naturally an experimental scientist reported failure when investigating haunted houses, apportations, and the like; his convictions prevented the phenomena from happening.

The deep jungles of Africa might be very different places—when there was no white man around to see! The strangely slippery laws of magic might still obtain.

Perhaps these speculations were too extreme; nevertheless, they had one advantage which orthodox concepts had not—they included Gramps Schneider's hexing of the deKalbs. Any working hypothesis which failed to account for Schneider's —and his own—ability to *think* a set of deKalbs into operation was not worth a continental. This one did, and it conformed to Gramps' own statements: "All matters are doubtful" and "A thing can both *be, not be,* and *be anything.* There are many true ways of looking at the same thing. Some ways are good, some are bad."

Very well. Accept it. Act on it. The world varied according to the way one looked at it. In that case, thought Waldo, he knew how he wanted to look at it—he cast his vote for order and predictability!

He would *set* the style. He would impress his *own* concept of the Other World on the cosmos!

It had been a good start to assure Gleason that the Schneider-treated deKalbs were foolproof. Good. So let it be. They were foolproof. They would never get out of order.

He proceeded to formulate and clarify his own concept of the Other World in his mind. He would think of it as orderly and basically similar to this space. The connection between the two spaces lay in the neurological system; the cortex, the thalamus, the spinal cord, and the appended nerve system were closely connected with both spaces. Such a picture was consistent with what Schneider had told him and did not conflict with phenomena as he knew it.

Wait—if the neurological system lay in both spaces, then that might account for the relatively slow propagation of nerve impulses as compared with electromagnetic progression. Yes! If the other space had a *c* constant relatively smaller than that of this space, such would follow.

He began to feel a calm assurance that it was *so.*

Was he merely speculating—or creating a universe?

Perhaps he would have to abandon his mental picture of the Other Space as being the size and shape of an ostrich egg, since a space with a slower propagation of light is not smaller, but larger, than the space he was used to. No . . . no, wait a second, the *size* of a space did not depend on its *c* constant, but on its radius of curvature in terms of its *c* constant. Since *c* was a velocity, size was dependent on the notion of time—in this case time as entropy rate. Therein lay a characteristic which could be compared between the two spaces; they exchanged energy, they affected each other's entropy. The one which degenerated the more rapidly toward a state of level entropy was the "smaller."

He need not abandon his picture of the ostrich egg—good old egg! The Other World was a closed space, with a slow *c*, a high entropy rate, a short radius, and an entropy state near level—a perfect reservoir of power at every point, ready to spill over into this space wherever he might close the interval. To its inhabitants, if any, it might seem to be hundreds of millions of light years around; to him it was an ostrich egg, turgid to bursting with power.

He was already beginning to think of ways of checking his hypothesis. If, using a Schneider-deKalb, he were to draw energy at the highest rate he could manage, would he affect the local potential? Would it establish an entropy gradient? Could he reverse the process by finding a way to

pump power into the Other World? Could he establish different levels at different points and thereby check for degeneration toward level, maximum entropy?

Did the speed of nerve impulse propagation furnish a clue to the c of the Other Space? Could such a clue be combined with the entropy and potential investigations to give a mathematical picture of the Other Space, in terms of its constants and its age?

He set about it. His untrammeled, wild speculations had produced some definite good; he'd tied down at least one line of attack on that Other Space, he'd devised a working principle for his blindman's telescope mechanism. Whatever the truth of the thing was, it was more than a truth; it was a complete series of new truths. It was the very complexity of that series of new truths—the truths, the characteristic laws, that were inherent properties of the Other Space, plus the new truth laws resultant from the interaction of the characteristics of the Other Space with Normal Space. No wonder Rambeau had said anything could happen! Almost anything could, in all probability, by a proper application and combination of the three sets of laws; the laws of Our Space, the laws of Other Space and the co-ordinate laws of Both Spaces.

But before theoreticians could begin work, new data were most desperately needed. Waldo was no theoretician, a fact he admitted left-handedly in thinking of theory as impractical and unnecessary time waste for him as a consulting engineer. Let the smooth apes work it out.

But the consulting engineer had to find out one thing; would the Schneider-deKalbs continue to function uninterruptedly as guaranteed? If not, what must be done to assure continuous function?

The most difficult and the most interesting aspect of the investigation had to do with the neurological system in relation to Other Space. Neither electromagnetc instruments nor neural surgery were refined enough to do accurate work on the levels he wished to investigate.

But he had waldoes.

The smallest waldoes he had used up to this time were approximately half an inch across their palms—with micro scanners to match, of course. They were much too gross for his purpose. He wished to manipulate living nerve tissues, examine its insulation and its performance *in situ*.

He used the tiny waldoes to create tinier ones.

The last stage were tiny metal blossoms hardly an eighth of an inch across. The helices in their stems, or forearms, which served them as pseudo muscles, could hardly be seen by the naked eye—but, then, he used scanners.

His final team of waldoes used for nerve and brain surgery varied in succeeding stages from mechanical hands nearly life size down to these fairy digits which could manipulate things much too small for the eye to see. They were mounted in bank to work in the same locus. Waldo controlled them all from the same primaries; he could switch from one size to another without removing his gauntlets. The same change in circuits which brought another size of waldoes under control automatically accomplished the change in sweep of scanning to increase or decrease the magnification so that Waldo always saw before him in his stereo receiver a "life-size" image of his other hands.

Each level of waldoes had its own surgical instruments, its own electrical equipment.

Such surgery had never been seen before, but Waldo gave that aspect little thought—no one had told him that such surgery was unheard of.

He established, to his own satisfaction, the mechanism whereby short-wave radiation had produced a deterioration in human physical performance. The synapses between dendrites acted as if they were points of leakage. Nerve impulses would sometimes fail to make the jump, would leak off—to where? To Other Space, he was sure. Such leakage seemed to establish a preferred path, a canalization, whereby the condition of the victim became steadily worse. Motor action was not lost entirely, as both paths were still available, but efficiency was lost. It reminded him of a metallic electrical circuit with a partial ground.

An unfortunate cat, which had become dead undergoing the experimentation, had supplied him with much of his data. The kitten had been born and raised free from exposure to power radiation. He subjected it to heavy exposure and saw it acquire a *myasthenia* nearly as complete as his own—while studying in minute detail what actually went on in its nerve tissues.

He felt quite sentimental about it when it died.

Yet, if Gramps Schneider were right, human beings need not be damaged by radiation. If they had the wit to look at it with the proper orientation, the radiation would not affect them—they might even draw power out of the Other World.

That was what Gramps Schneider had told him to do.

That was what Gramps Schneider had told *him* to do!

Gramps Schneider had told him he need not be weak!

That he could be strong—

Strong!

STRONG!

He had never thought of it. Schneider's friendly ministrations to him, his advice about overcoming the weakness, he had ignored, had thrown off as inconsequential. His own weakness, his own

peculiarity which made him different from the smooth apes, he had regarded as a basic, implicit fact. He had accepted it as established when he was a small child, a final unquestioned factor.

Naturally he had paid no attention to Schneider's words in so far as they referred to him.

To be strong!

To stand alone—to walk, to *run!*

Why, he . . . he could, he could go down to Earth surface without fear. He wouldn't mind the field—they *said* they didn't mind it; they even *carried* things, great, heavy things. Everybody did. They *threw* things.

He made a sudden convulsive movement in his primary waldoes, quite unlike his normal, beautifully economical rhythm. The secondaries were oversize, as he was making a new set-up. The guys tore loose, a brace plate banged against the wall. Baldur was snoozing nearby; he pricked up his ears, looked around, then turned his face to Waldo, questioning him.

Waldo glared at him, the dog whined. "Shut up!"

The dog quieted and apologized with his eyes.

Automatically he looked over the damage—not much but he would have to fix it. Strength—why, if he were strong he could do anything—anything! No. 6 extension waldoes and some new guys—Strong! Absent-mindedly he shifted to the No. 6 waldoes.

Strength!

He could even meet women—be stronger than they were!

He could swim. He could ride. He could fly a ship. Run, jump—he could handle things with his bare hands. He could even learn to dance!

Strong!

He would have muscles! He could break things.

He could— He could—

He switched to the great waldoes with hands the size of a man's body. Strong—they were strong! With one giant waldo he hauled from the stock pile a quarter-inch steel plate, held it up and shook it. A booming rumble—he shook it again. Strong!

He took it in both waldoes, bent it double. The metal buckled unevenly. Convulsively he crumpled it like waste paper between the two huge palms. The grinding racket raised hackles on Baldur; he himself had not been aware of it.

He relaxed for a moment, gasping. There was sweat on his forehead; blood throbbed in his ears. But he was not spent; he wanted something heavier, *stronger.* Cutting to the adjoining storeroom he selected an L-beam twelve feet long, shoved it through to where the giant hands could reach it, and cut back to them.

The beam was askew in the port; he wrenched it loose, knocking a big dent in the port frame. He did not notice it.

The beam made a fine club in the gross fist. He brandished it. Baldur backed away, placing the control ring between himself and the great hands.

Power! Strength! Smashing, unbeatable strength—

With a spastic jerk he checked his swing just before the beam touched the wall. No— But he grabbed the other end of the club with the left waldo and tried to bend it. The big waldoes were built for heavy work, but the beam was built to resist. He strained, inside the primaries, strove to force the great fists to do his will. A warning light flashed on his control board. Blindly, he kicked in the emergency overload and persisted.

The hum of the waldoes and the rasp of his own breath were drowned out by the harsh scrape of metal on metal as the beam began to give way. Exulting, he bore down harder in the primaries. The beam was bending double when the waldoes blew out. The right-hand tractors let go first; the fist flung open. The left fist, relieved of the strain, *threw* the steel from it.

It tore its way through the thin bulkhead, making a ragged hole, crashed and clanged in the room beyond.

But the giant waldoes were inanimate junk.

He drew his soft pink hands from the waldoes and looked at them. His shoulders heaved and racking sobs pushed up out of him. He covered his face with his hands; the tears leaked out between his fingers. Baldur whimpered and edged in closer.

On the control board a bell rang persistently.

The wreckage had been cleared away and an adequate, neat patch covered the place where the L-beam had made its own exit. But the giant waldoes had not yet been replaced; their frame was uninhabited. Waldo was busy rigging a strength tester.

It had been years since he had paid any attention to the exact strength of his body. He had had so little use for strength; he had concentrated on dexterity, particularly on the exact and discriminating control of his namesakes. In the selective, efficient, and accurate use of his muscles he was second to none; he had control—he *had* to have. But he had had no need for strength.

With the mechanical equipment at hand it was not difficult to jury-rig a device which would register strength of grip as pounds-force on a dial—a spring-loaded scale and a yoke to act on it sufficed. He paused and looked at the contrivance.

He need only take off the primary waldoes; place his bare hand on the grip, bear down—and he would know. Still he hesitated.

It felt strange to handle anything so large with

his bare hand. Now—reach into the Other World for power. He closed his eyes and pressed. He opened them. Fourteen pounds—less than he used to have.

But he had not really tried yet. He tried to imagine Gramps Schneider's hands on his arm. that warm tingle. Power—reach out and claim it.

Fourteen pounds, fifteen—seventeen, eighteen, twenty, twenty-one! He was winning—he was winning!

Both his strength and his courage failed him, in what order he could not say. The needle spun back to zero; he had to rest.

Had he really shown exceptional strength—or was twenty-one pounds of grip simply normal for him at his present age and weight? A normally strong and active man, he knew, should have a grip on the order of one hundred fifty pounds.

Nevertheless, twenty-one pounds of grip was six pounds higher than he had ever before managed on test.

Try again. Ten, eleven—twelve. Thirteen. The needle hesitated. Why, he had just started—this was ridiculous. Fourteen.

There it stopped. No matter how he strained and concentrated his driving will he could not pass that point. Slowly, he dropped back from it.

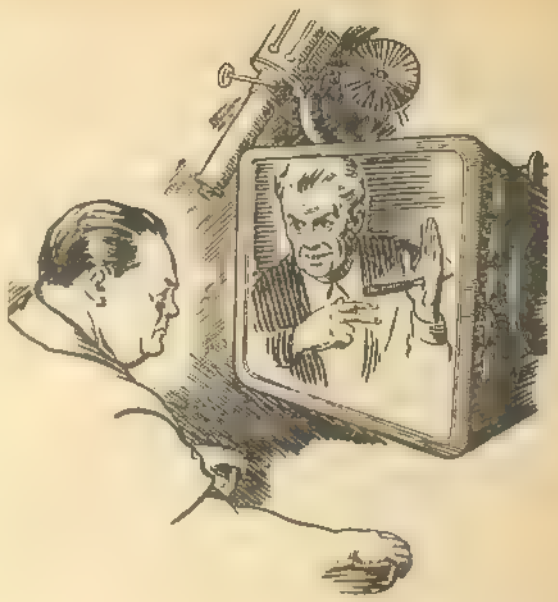
Sixteen pounds was the highest he managed in the following days. Twenty-one pounds seemed to have been merely a fluke, a good first effort. He ate bitterness.

But he had not reached his present position of wealth and prominence by easy surrender. He persisted, recalling carefully just what Schneider had said to him, and trying to *feel* the touch of Schneider's hands. He told himself now that he really had been stronger under Schneider's touch, but that he had failed to realize it because of the Earth's heavy field. He continued to try.

In the back of his mind he knew that he must eventually seek out Gramps Schneider and ask his help, if he did not find the trick alone. But he was extremely reluctant to do so, not because of the terrible trip it entailed—though that would ordinarily have been more than enough reason—but because if he did so and Schneider was not able to help him, then there would be no hope, no hope at all.

It was better to live with disappointment and frustration than to live without hope. He continued to postpone it.

Waldo paid little attention to Earth time; he ate and slept when he pleased. He might catch a cat nap at any time; however at fairly regular intervals he slept for longer periods. Not in a bed, of course. A man who floats in air has no need for a bed. But he did make it a habit to guy himself into place before undertaking eight hours



of solid sleep, as it prevented him from casual drifting in random air currents which might carry him, unconscious, against controls or switches.

Since the obsession to become strong had possessed him he had frequently found it necessary to resort to soporifics to insure sleep.

Dr. Rambeau had returned and was looking for him. Rambeau—crazy and filled with hate. Rambeau, blaming his troubles on Waldo. He was not safe, even in Freehold, as the crazy physicist had found out how to pass from one space to another. There he was now! Just his head, poked through from the Other World. "I'm going to get you, Waldo!" He was gone—no, there he was behind him! Reaching, reaching out with hands that were writhing antennæ. "You, Waldo!" But Waldo's own hands were the giant waldoes; he snatched at Rambeau.

The big waldoes went limp.

Rambeau was at him, was on him; he had him around the throat.

Gramps Schneider said in his ear, in a voice that was calm and strong, "Reach out for the power, my son. Feel it in your fingers." Waldo grabbed at the throttling fingers, strained, tried.

They were coming loose. He was winning. He would stuff Rambeau back into the Other World and keep him there. There! He had one hand free. Baldur was barking frantically; he tried to tell him to shut up, to bite Rambeau, to help—

The dog continued to bark.

He was in his own home, in his own great room. Baldur let out one more yipe. "Quiet!" He looked himself over.

When he had gone to sleep he had been held in place by four light guys, opposed like the axes of a tetrahedron. Two of them were still

fastened to his belt; he swung loosely against the control ring. Of the other two, one had snapped off at his belt; its end floated a few feet away. The fourth had been broken in two places, near his belt and again several feet out; the severed piece was looped loosely around his neck.

He looked the situation over. Study as he might, he could conceive no way in which the guys could have been broken save by his own struggles in the nightmare. The dog could not have done it; he had no way to get a purchase. He had done it himself. The lines were light, being intended merely as stays. Still—

It took him a few minutes to rig a testing apparatus which would test pull instead of grip; the yoke had to be reversed. When it was done he cut in a medium waldo pair, fastened the severed piece of line to the tester, and, using the waldo, pulled.

The line parted at two hundred and twelve pounds.

Hastily, but losing time because of nervous clumsiness, he rerigged the tester for grip. He paused, whispered softly, "Now is the time, Gramps!" and bore down on the grip.

Twenty pounds—twenty-one. Twenty-five!

Up past thirty—he was not even sweating. Thirty-five—forty, -one, -two, -three. Forty-five! And six! And a half. Forty-seven pounds!

With a great sigh he let his hand relax. He was strong. Strong.

When he had somewhat regained his composure, he considered what to do next. His first impulse was to call Grimes, but he suppressed it. Soon enough when he was sure of himself.

He went back to the tester and tried his left hand. Not as strong as his right, but almost—nearly forty-five pounds. Funny thing, he didn't feel any different, just—normal, healthy. No sensation.

He wanted to try all of his muscles. It would take too long to rig testers for kick, and shove, and back lift, and, oh, a dozen others. He needed a field, that was it, a one-g field. Well, there was the reception room—it could be centrifuged.

But its controls were in the ring and it was long corridors away. There was a nearer one, the centrifuge for the cuckoo clock. He had rigged the wheel with a speed control as an easy way to regulate the clock. He moved back to the control ring and stopped the turning of the big wheel; the clockwork was disturbed by the sudden change; the little red bird popped out, said, *"Th-wu th-woo"* once, hopefully, and subsided.

Carrying in his hand a small control panel radio-hooked to the motor which impelled the centrifuge wheel, he propelled himself to the wheel and placed himself inside, planting his feet on the inner surface of the rim and grasping one of the spokes, so that he would be in a standing position with respect to the centrifugal force, once it was impressed. He started the wheel slowly.

Its first motion surprised him and he almost fell off. But he recovered himself and gave it a little more power. All right so far. He speeded it up gradually, triumph spreading through him as he felt the pull of the pseudo gravitational field, felt his legs grow heavy, *but still strong!*

He let it out, one full g. He could take it. He could, indeed! To be sure, the force did not affect the upper part of his body as strongly as the lower, as his head was only a foot or so from the point of rotation. He could fix that; he squatted down slowly, hanging on tight to the spoke. It was all right.

But the wheel swayed and the motor complained. His unbalanced weight, that far out from the center of rotation, was putting too much of a strain on a framework intended to support a cuckoo clock and its counterweight only. He straightened up with equal caution, feeling the fine *shove* of his thigh muscles and calves. He stopped the wheel.

Baldur had been much perturbed by the whole business. He had almost twisted his neck off trying to follow the motions of Waldo.

He still postponed calling Grimes. He wanted to arrange for some selective local controls on the centrifuging of the reception room, in order to have a proper place in which to practice standing up. Then he had to get the hang of this walking business; it looked easy, but he didn't know. Might be quite a trick to learn it.

Thereafter he planned to teach Baldur to walk. He tried to get Baldur into the cuckoo-clock wheel, but the dog objected. He wiggled free and retreated to the farthest part of the room. No matter—when he had the beast in the reception room he would damn well have to learn to walk. Should have seen to it long ago—a big brute like that and couldn't walk!

He visualized a framework into which the dog could be placed which would force him to stand erect. It was roughly equivalent to a baby's toddler, but Waldo did not know that. He had never seen a baby's toddler.

"Uncle Gus—"

"Oh, hello, Waldo. How you been?"

"Fine. Look, Uncle Gus, could you come up to Freehold—right away?"

Grimes shook his head. "Sorry. My bus is in the shop."

"Your bus is too slow, anyhow. Take a taxi, or get somebody to drive you."

"And have you insult 'em when we got there? Huh-uh."

"I'll be sweet as sugar."

"Well—Jimmie Stevens said something yesterday about wanting to see you."

Waldo grinned. "Get him. I'd like to see him."

"I'll try."

"Call me back. Make it soon."

Waldo met them in the reception room, which he had left uncentrifuged. As soon as they came in he started his act. "My, I'm glad you're here. Dr. Stevens—could you fly me down to Earth right away? Something's come up."

"Why—I suppose so."

"Let's go."

"Wait a minute, Waldo. Jimmie's not prepared to handle you the way you have to be handled."

"I'll have to chance it, Uncle Gus. This is urgent."

"But—"

"No 'buts.' Let's leave at once."

They hustled Baldur into the ship and tied him down. Grimes saw to it that Waldo's chair was tilted back in the best approximation of a deceleration rig. Waldo settled himself into it and closed his eyes to discourage questions. He sneaked a look and found Grimes grimly silent.

Stevens made very nearly a record trip, but set them down quite gently on the parking flat over Grimes' home. Grimes touched Waldo's arm. "How do you feel? I'll get someone and we'll get you inside. I want to get you to bed."

"Can't do that, Uncle Gus. Things to do. Give me your arm, will you?"

"Huh?" But Waldo reached for the support requested and drew himself up.

"I'll be all right now, I guess." He let go the physician's arm and started for the door. "Will you untie Baldur?"

"Waldo!"

He turned around, grinning happily. "Yes, Uncle Gus, it's true. I'm not weak any more. *I can walk.*"

Grimes took hold of the back of one of the seats and said shakily, "Waldo, I'm an old man. You ought not to do things like this to me." He wiped at his eyes.

"Yes," agreed Stevens, "it's a damn dirty trick."

Waldo looked blankly from one face to the other. "I'm sorry," he said humbly. "I just wanted to surprise you."

"It's all right. Let's go downside and have a drink. You can tell us about it then."

"All right. Come on, Baldur." The dog got up and followed after his master. He had a very curious gate; Waldo's trainer gadget had taught him to pace instead of trot.

Waldo stayed with Grimes for days, gaining strength, gaining new reflex patterns, building up his flabby muscles. He had no setbacks; the *myasthenia* was gone—all he required was conditioning.

Grimes had forgiven him at once for his unnecessarily abrupt and spectacular revelation of his cure, but Grimes had insisted that he take it easy and become fully readjusted before he undertook to venture out unescorted. It was a wise precaution. Even simple things were hazards to him. Stairs, for example—he could walk on the level, but going downstairs had to be learned. Going up was not as difficult.

Stevens showed up one day, let himself in, and found Waldo alone in the living room, listening to a stereo show. "Hello, Mr. Jones."

"Oh—hello, Dr. Stevens." Waldo reached down hastily, fumbled for his shoes, zipped them on. "Uncle Gus says I should wear them all the time," he explained. "Everybody does. But you caught me unawares."

"Oh, that's no matter. You don't have to wear them in the house. Where's Doc?"

"Gone for the day. Don't you, really? Seems to me my nurses always wore shoes."

"Oh, yes, everybody does—but there's no law to make you."

"Then I'll wear them. But I can't say that I like them. They feel dead, like a pair of disconnected waldoes. But I want to learn how."

"How to wear shoes?"

"How to act like people act. It's really quite difficult," he said seriously.

Stevens felt a sudden insight, a welling of sympathy for this man with no background and no friends. It must be odd and strange to him. He felt an impulse to confess something which had been on his mind with respect to Waldo. "You really are strong now, aren't you?"

Waldo grinned happily. "Getting stronger every day. I gripped two hundred pounds this morning. And see how much fat I've worked off."

"You're looking fit, all right. Here's a funny thing—ever since I first met you I've wished to high heaven that you were as strong as an ordinary man."

"You really did? Why?"

"Well . . . I think you will admit that you used some pretty poisonous language to me, one time and another. You had me riled up all the time. I wanted you to get strong so that I could just beat the hell out of you."

Waldo had been walking up and down, getting used to his shoes. He stopped and faced Stevens. He seemed considerably startled. "You mean you wanted to fist-fight me?"

"Exactly. You used language to me that a man ought not to use unless he is prepared to back it up with his fists. If you had not been an invalid I would have pasted you one . . . oh, any number of times."

Waldo seemed to be struggling with a new concept. "I think I see," he said slowly. "Well—

all right." On the last word he delivered a roundhouse swipe with plenty of power behind it. Stevens was not in the least expecting it; it happened to catch him on the button. He went down, out cold.

When he came to he found himself in a chair. Waldo was shaking him. "Wasn't that right?" he said anxiously.

"What did you hit me with?"

"My hand. Wasn't that right? Wasn't that what you wanted?"

"Wasn't that what I—" He still had little bright lights floating in front of his eyes, but the situation began to tickle him. "Look here—is that your idea of the proper way to start a fight?"

"Isn't it?"

Stevens tried to explain to him the etiquette of fisticuffs, contemporary American. Waldo seemed puzzled, but finally he nodded. "I get it. You have to give the other man warning. All right—get up, and we'll do it over."

"Easy, easy! Wait a minute. You never did give me a chance to finish what I was saying. I was sore at you, but I'm not any more. That is what I was trying to tell you. Oh, you were utterly poisonous; there is no doubt about that. But you couldn't help being."

"I don't mean to be poisonous," Waldo said seriously.

"I know you don't, and you're not. I rather like you now . . . now that you're strong."

"Do you, really?"

"Yes, I do. But don't practice any more of those punches on me."

"I won't. But I didn't understand. But, do you know, Dr. Stevens, it's—"

"Call me Jim."

"Jim. It's a very hard thing to know just what people do expect. There is so little pattern to it. Take belching—I didn't know it was forbidden to burp when other people are around. It seems obviously necessary to me. But Uncle Gus says not."

Stevens tried to clear up the matter for him—not too well, as he found that Waldo was almost totally lacking in any notion, even theoretical, of social conduct. Not even from fiction had he derived a concept of the intricacies of *mores*, as he had read almost no fiction. He had ceased reading stories in his early boyhood, because he lacked the background of experience necessary to appreciate fiction.

He was rich, powerful, and a mechanical genius, but he still needed to go to kindergarten.

Waldo had a proposition to make. "Jim, you've been very helpful. You explain these things better than Uncle Gus does. I'll hire you to teach me."

Stevens suppressed a slight feeling of pique. "Sorry. I've got a job that keeps me busy."

"Oh, that's all right. I'll pay you better than they do. You can name your own salary. It's a deal."

Stevens took a deep breath and sighed. "You don't understand. I'm an engineer and I don't hire out for personal service. You can't hire me . . . oh, I'll help you all I can, but I won't take money for it."

"What's wrong with taking money?"

The question, Stevens thought, was stated wrongly. As it stood it could not be answered. He launched into a long, involved discussion of professional and business conduct. He was really not fitted for it; Waldo soon bogged down. "I'm afraid I don't get it. But see here—could you teach me how to behave with girls? Uncle Gus says he doesn't dare take me out in company."

"Well, I'll try. I'll certainly try. But, Waldo, I came over to see you about some of the problems we're running into at the plant. About this theory of the two spaces that you were telling me about—"

"It's not theory; it's fact."

"All right. What I want to know is this: When do you expect to go back to Freehold and resume research? We need some help."

"Go back to Freehold? I haven't any idea. I don't intend to resume research."

"You don't? But, my heavens, you haven't finished half the investigations you outlined to me."

"You fellows can do 'em. I'll help out with suggestions, of course."

"Well—maybe we could interest Gramps Schneider," Stevens said doubtfully.

"I would not advise it," Waldo answered. "Let me show you a letter he sent me." He left and fetched it back. "Here."

Stevens glanced through it. "—your generous offer of your share in the new power project I appreciate, but, truthfully, I have no interest in such things and would find the responsibility a burden. As for the news of your new strength I am happy, but not surprised. The power of the Other World is his who would claim it—" There was more to it. It was written in a precise Spencerian hand, a trifle shaky; the rhetoric showed none of the colloquialisms with which Schneider spoke.

"Hm-m-m—I think I see what you mean."

"I believe," Waldo said seriously, "that he regards our manipulations with gadgets as rather childish."

"I suppose. Tell me, what do *you* intend to do with yourself?"

"Me? I don't know, exactly. But I can tell you this: I'm going to have fun. I'm going to have

lots of fun. I'm just beginning to find out how much fun it is to be a man!"

• • • • • •

His dresser tackled the other slipper. "To tell you just why I took up dancing would be a long story," he continued.

"I want details."

"Hospital calling," someone in the dressing room said.

"Tell 'em I'll be right there, fast. Suppose you come in tomorrow afternoon?" he added to the woman reporter. "Can you?"

"Right." A man was shouldering his way through the little knot around him. He caught his eye.

"Hello, Stanley. Glad to see you."

"Hello, Waldo." Gleason pulled some papers out from under his cape and dropped them in the dancer's lap. "Brought these over myself as I wanted to see your act again."

"Like it?"

"Swell!"

Waldo grinned and picked up the papers. "Where is the dotted line?"

"Better read them first," Gleason cautioned him.

"Oh, shucks, no. If it suits you, it suits me. Can I borrow your stylus?"

A worried little man worked his way up to them. "About that recording, Waldo—"

"We've discussed that," Waldo said flatly. "I only perform before audiences."

"We've combined it with the Warm Springs benefit."

"That's different. O. K."

"While you're about it, take a look at this layout." It was a reduction, for a twenty-four sheet:

THE GREAT WALDO
and His Troupe

with the opening date and theater left blank, but with a picture of Waldo, as Harlequin, poised high in the air.

"Fine, Sam, fine!" Waldo nodded happily.

"Hospital calling again!"

"I'm ready now," Waldo answered, and stood up. His dresser draped his street cape over his lean shoulders. Waldo whistled sharply. "Here, Baldur! Come along." At the door he stopped an instant, and waved. "Good night, fellows!"

"Good night, Waldo."

They were all such grand guys.

THE END.

MACHINIST'S NIGHTMARE

The construction of a cyclotron requires a new sort of specialist, an engineer who hasn't existed in the world before. Installing a cyclotron is something of a cross between a job for a steelwork and bridge engineer, a radio broadcast station installation engineer, and an instrument technician. But the cyclotron gives headaches not only to the men who design, build and work with them, but to the technicians who supply the targets used in the cyclotron experiments.

You've read of bombarding a beryllium target to produce neutrons, or a lithium target to get this, that, or the other thing; any idea what that vaguely mentioned "target" is? It has to be a piece of the element machined on a lathe to a certain size and shape, and fitted into the target supports. And the machinist who gets the job of supplying those targets gets, at one time, the screwiest headache going, and one of the most fascinating.

Steels are recommended for this job or that, alloys are made commercially for specific types of work—depending on their machineability. Some metals are tough and rubbery—very hard to machine. Some are soft and gummy; they clog the tools. Some are brittle and can't be turned decently. But machine-shop practice has developed the best way to handle every type of steel and all the commercial alloys.

But, somehow, machine-shop practice handbooks don't list the correct technique for turning out a two-inch-cylinder from metallic uranium castings. And the best technique for use on zirconium, gadolinium, lithium, ytterbium and indium seem to be missing too. Uranium and some of the others aren't nice playmates—they burn on the slightest excuse, or none at all. And the technician never knows what sort of machining properties a metal has until he tries it; no one had ever thought of turning out cylinders of metallic scandium before the cyclotron boys started calling for 'em.

DEADLOCK

By Lewis Padgett

● The indestructible robot was a swell little gadget in that time of feudal corporations. But—most went mad, and were still indestructible. The rest—

Illustrated by Kolliker

Thor was the first robot who didn't go mad. It might have been better had he followed the example of his forerunners.

The trouble, of course, lay in creating a sufficiently complicated thinking machine that wouldn't be *too* complicated. Balder IV was the first robot that could be called successful, and after three months he began to behave erratically, giving the wrong answers and spending most of his time staring blankly at nothing. When he became actually destructive, the Company took steps. Naturally, it was impossible to destroy a duraloy-constructed robot, but they buried Balder IV in concrete. Before the stuff had set, it was necessary to throw Mars II after him.

The robots worked—yes. For a time. Then there was an ambiguous sort of mental breakdown, and they cracked up. The Company couldn't even salvage the parts—a blowtorch couldn't melt plastic duraloy after it had hardened, and so twenty-eight robots, thinking lunatic thoughts, reposed in beds of cement, reminding Chief Engineer Harnahan of Reading Gaol.

"And their grave has no name," Harnahan amplified, lying full length on the couch in his office and blowing smoke rings.

He was a big man with tired eyes and a perpetually worried frown. No wonder, in this day of gigantic corporations that fought each other tooth and nail for economic supremacy. It was vaguely feudal, for if a company went under, it was annexed by its conqueror, and *vae victis.*

Van Damm, who was more of a trouble-shooter than anything else, sat on the edge of the desk, biting his nails. Small, gnomish, and dark as a Pict, his shrewd wrinkled face was as impassive as that of Thor, who stood motionless against the wall. Now Van Damm looked at the robot.

"How do you feel?" he asked. "Any sign of a mental crack-up?"

Thor said, "Mentally I am in fine shape, ready to cope with any problem."

Harnahan turned over on his stomach. "O. K. Cope with this, then. Luxingham Incorporated swiped Dr. Sadler and his formula for increasing the tensile strength of mock-iron. The louse was holding out on us for a bigger salary. Now he's taken a run-out powder and gone over to Luxingham."

Thorn nodded. "Contract?"

"Fourteen-X-Seven. The usual metallurgist's contract. Technically unbreakable."

"The courts would uphold us. However, by this time Luxingham's facial surgeons would have altered Sadler's body and fingerprints. The case would run . . . two years. By that time Luxingham would have made sufficient use of the mock-iron formula."

Van Damm made a horrible face. "Solution, Thor." He shot a quick glance at Harnahan. Both men knew what was coming. Thor didn't disappoint them.

"Force," the robot remarked. "You need the formula. A robot is not legally responsible—as yet. I'll visit Luxingham."

"O. K.," Harnahan said reluctantly, and Thor turned and went out. The chief engineer scowled.

"Yeah," Van Damm nodded. "I know. He'll just walk in and snaffle the formula. And we'll get another injunction against operating an uncontrollable machine. And we'll keep on just as we have been doing."

"Is brute force the best logic?" Harnahan wondered.

"The simplest, maybe. Thor doesn't need to work out complicated legal methods. He's indestructible. He'll just walk into Luxingham and take the formula. If the courts decide Thor's dangerous, we can bury him in cement and make more robots. He's without ego, you know. It won't matter to him."

"We expected more," Harnahan grumbled. "A thinking machine ought to be able to do a lot."

"Thor can do a lot. So far, he hasn't gone crazy like the others. He's solved every problem we've given him—even that trend chart that had everyone else buffaloed."

Harnahan nodded. "Yeah. He predicted Snow-

many's election . . . that got the Company out of a scrape. He can think, all right. For my money, there's no problem he can't solve. Just the same, he isn't inventive."

"If the occasion arose—" Van Damm went off at a tangent. "We've got the monopoly on robots, anyhow. Which is something. It's about time to give the go-ahead signal on more robots of Thor's type."

"Better wait a bit. See if Thor goes crazy. He's the most complicated one so far."

The visiphone on the desk came to life with an outraged screech. "Harnahan! You lousy, unethical murderer! You—"

"I'm recording that, Blake," the engineer called as he stood up. "You'll get a libel suit slammed on you within the hour."

"Sue and be damned," Blake of Luxingham Incorporated yelled. "I'm coming over and break your prognathous jaw myself! So help me, I'll burn you down and spit on the ashes!"

"Now he's threatening my life," Harnahan said in a loud aside to Van Damm. "Lucky I'm recording this on the tape."

Blake's crimson face on the screen seemed to swell visibly. Before it burst, however, another portrait took its place—the smooth, bland countenance of Marshal Yale, police administrator to the sector. Yale looked worried.

"Look, Mr. Harnahan," he said sadly, "this can't keep up. Now just look at things sensibly, will you? After all, I'm an officer of the law—"

"Ha!" remarked Van Damm, *sotto voce*.

"—and outright mayhem is something I can't condone. Maybe your robot's gone mad?" he added hopefully.

"Robot?" Harnahan asked, his face blank. "I don't understand. What robot's that?"

Yale sighed. "Thor. Thor, of course. Who else? Now I realize you don't know a thing about it"—his voice was as heavily sarcastic as he dared to make it—"but Thor has just walked into Luxingham and played merry hell."

"No!"

"Yes. He walked right in. The guards tried to stop him, but he just kept on going. He stepped on 'em, in fact. They played a flame hose on him, but he didn't stop for that. Luxingham got out every defense weapon in their arsenal, and that

infernal robot of yours simply kept on going. He grabbed Blake by the neck and made him unlock the lab door. And he took a formula away from one of the technicians."

"I *am* surprised," Harnahan said, shocked. "By the way, which technician was it? Not a guy named Sadler?"

"I dunno . . . wait a minute. Yes, Sadler."

"But Sadler's working for us," the engineer explained. "We've got him on a beryl-bound contract. Any formulas he works out belong to us."

Yale mopped his shining cheeks. "Mr. Harnahan, please!" he said desperately. "If you'd only think of the spot I'm in! Legally I'm bound to do something about this. You can't let one of your robots try strong-arm stuff like that. It's too . . . too—"

"Obvious?" Harnahan suggested. "Well, as I say, it's all news to me. I'll check up and call you back. By the way, I'm preferring charges against Blake. Libel, and homicidal threats."

"Oh, my God," Yale said, and broke the beam.

Van Damm and Harnahan exchanged delighted glances.

"Fair enough," the gnomish trouble-shooter chuckled. "It's deadlock. Blake won't try bombing us—we've both got too many antiaircraft defenses—so it'll go to the courts. Courts!" He pursed his mouth wryly.

Harnahan returned to the couch. "Best thing we ever did was to concentrate on those robots. Within ten years the Company will own the world. And other worlds. We can send out spaceships, with robot operators."

The door opened, and Thor appeared, looking none the worse for his ordeal. He put a slip of metal-plaque on the desk.

"Formula for mock-iron."

"Hurt?"

"Impossible."

Thor went to a filing cabinet, secured an envelope, and vanished again. Harnahan rose to study the plaque.

"Yeah. This is it." He slipped it into a conveyor slot. "Things are too easy sometimes. Guess I'll knock off for the day. Say! What was Thor up to just now?"

Van Damm looked at him. "Eh?"

"At the files. What's on his mind?" Harnahan investigated. "Some electronic thesis—I don't know what he wanted with that. Perhaps he's going to do some research on his own."

"Maybe," Van Damm said. "Let's go see."

They took a dropper to the robot's workshop in the basement, but the room was empty. Harnahan used the teleview.

"Check-up. Where's Thor?"

"One moment, sir. . . . In the Seven Foundry. Shall I connect you with the foreman?"

"Yeah. Ivar? What's Thor up to?"

Ivar rubbed his bullet head. "Damfino. He ran in, grabbed a tensile chart, and ran out again. Wait a bit. He's back again."

"Let me talk to him," Harnahan said.

"Sure—" Ivar's craggy face vanished, and presently reappeared. "No soap. He picked up a chunk of syntho-plat and went."

"Hm-m-m," Van Damm put in. "Do you suppose—"

"He's going crazy like the others?" Harnahan scowled. "They didn't act like that. Still, it's possible."

Just then Thor appeared, his rubbery arms laden with an incongruous array of practically everything. Ignoring the two men, he dumped the stuff on a bench and began to rearrange it, working with swift accuracy.

"He isn't crazy," Harnahan said. "The light's on."

In Thor's forehead was a crimson stud that lighted whenever the robot was working on a problem. It was a new improvement, a telltale for robot-madness. Had it been flashing intermittently, there would have been something to worry about—mixing a fresh batch of concrete to provide a grave for a crazy robot.

"Thor!" Van Damm said sharply. The robot didn't reply.

"Must be a big problem," Harnahan frowned. "Wonder what it is?"

"I'm wondering what gave him the idea," the trouble-shooter said. "Something that occurred lately, that's certain. An improvement on the mock-iron process?"

"Possibly. Hm-m-m." They watched the busy robot for awhile, learning nothing; and finally went back to Harnahan's office, where they had a drink, and speculated on what Thor was inventing. Van Damm thought it would be a mock-iron improvement. Harnahan didn't agree, but had no better ideas.

Matters were not clarified when the teleview announced that there had been an explosion in the basement.

"Atomic energy!" Harnahan gulped, rising from the couch in one jerky motion. Van Damm was at his heels as they sped toward the dropper. In the basement, a knot of men was gathered around the door to Thor's workshop.

Harnahan pushed through them and stepped across the threshold into a cloud of concrete dust. As it cleared, he saw the disjointed remains of Thor at his feet. The robot was obviously beyond repair.

"Funny!" Harnahan muttered. "That wasn't an especially severe explosion. If it wrecked Thor, it should have wrecked the plant—or the basement anyway. His duraloy's half melted."

Van Damm didn't answer. Harnahan looked up

to see the trouble-shooter staring into the clouds of dust at a gadget that hung in midair a few feet away.

It was a gadget—just that. Harnahan recognized several of the parts that Thor had brought into his workshop. But the sum total was rather baffling. The device served no discernible purpose. It looked like the sort of toy an erratic child might construct with a mechano set.

Roughly cylindrical, it was about two feet long, and a foot thick. There was a lens in it, and moving parts, and a helical coil. It buzzed.

That was all.

"Well," Harnahan said, "what in the name of Balaam's ass is it?"

Van Damm carefully stepped back to the remains of the door. He barked hurried commands. Panels slid shut, and a man in blue uniform hurried to the trouble-shooter.

"Blocked off, chief."

"Yeah," Van Damm said. "Use the hypnotic treatment on these boys." He nodded toward the score or so of workmen, and there was a shuffling movement among them.

"Requesting the reason, sir," someone called.

Van Damm grinned at them. "Fair enough. You saw what was left of Thor. If it gets out that one of our indestructible robots can be destroyed, the other companies will get busy. Remember what happened with the old-style robots we made? They were sabotaged—that was why we developed the duraloy robot. It's the only practical kind. We'll just erase from your brains the realization that Thor was burned down. Then Luxingham or the others can't get hold of that info, even if they use scopolamin on you."

Satisfied, the men filed out one by one. Harnahan was still looking blankly at the gadget.

"No switches on the thing," he remarked. "Wonder what activates it?"

"Thought, maybe," Van Damm said. "But be careful. We don't want to start it working till we know what it's for."

"You're talking sense," Harnahan nodded, his face suddenly changing. "I'm only now beginning to realize the implications of this. Thor was supposedly indestructible."

"Nothing is, completely."

"I know. But duraloy—hm-m-m. Look at that lens. Could it be for the purpose of focusing some destructive ray that'd upset the atomic structure of alloys? No. What's left of Thor is still duraloy. It couldn't be that. Still—*look out!*" He dived out of the way as the gadget revolved slowly in midair.

Van Damm ducked toward the door. "You've set it off! Let's get out of here!"

He was too late. The gadget swooped over his head, removing a gray lock in transit, and banged against a metal barrier across the basement. Harnahan and Van Damm stood in the doorway of the robot's room and watched the device slowly eat its way through solid steel.

Presently it vanished.

Harnahan glanced at the teleview behind him. It was broken by the force of the blast. He shivered a little and said, "We'd better follow the thing. Do . . . do you suppose—" He stopped.

Van Damm peered at him sharply. "Uh?"

"Nothing. I guess. But . . . I'm wondering about mechanical mutation."

"You're crazy as a robot," Van Damm said explicitly. "Mechanical fudge!"

"Look, though. When life reaches a crucial point it mutates. That's a biological law. Suppose Thor created a robot greater than he ever was, and . . . and—"

"That thing," said Van Damm, pointing to the hole in the wall, "is no robot, whatever else it may be. It's a machine. It isn't a thinking machine, either. But it's got power, plenty of that. Our business is to find out how that power should be applied." He hesitated. "Could we run a recording from Thor's brain?"

Harnahan shook his head. "No soap. His brain's burned out. I checked that."

"And robots don't leave notes. Well, it shouldn't be impossible to find out what that gadget does."

"It burns holes through steel, anyway," Harnahan remarked.

"And it stops watches," said Van Damm, glancing at his wrist timepiece. "We might try putting ourselves in the place of a robot and seeing what he'd invent."

Harnahan glared at the trouble-shooter and hurried through a door in the metal barrier. There was no sign of the gadget beyond the threshold. A hole in the ceiling gave the answer.

They went upstairs, and a hall teleview informed them that the gadget was in one of the machine shops, doing nothing. It was still doing nothing when Van Damm and Harnahan arrived. Fifty metal lathes were aligned in neat rows, and the workers were staring up at the floating gadget in a baffled fashion.

The foreman approached. "What is it?" he wanted to know. "One of Luxingham's tricks? Bomb, maybe?"

"What's it done?"

"Nothing much. Only the lathes won't work."

Van Damm seized a long, metal-tipped pole and approached the gadget. It floated slowly away. He maneuvered it into a corner and jabbed it with the pole, with no discernible result. The tone

of the buzzing remained unaltered.

"Try the lathes now," Harnahan suggested.

They still didn't work. But the gadget, scenting new worlds to conquer, slid toward a door, burned its way through it, and disappeared.

It was now outside the great building. From the porch that jutted out on the clifflike wall, Harnahan and Van Damm could look up and see the gadget levitating itself smoothly toward the sky. At a point far above them it disappeared, and shards of flexiglass tinkled down as they dodged in.

"Up!" Harnahan said succinctly. "I've a hunch that was Twill's office."

It was unnecessary to say more. Joseph Twill was one of the partners in the Company, a godlike being who dwelt in the rarefied atmosphere of the upper towers.

Alarmed guards let them into Twill's offices. As Harnahan had feared, the worst had happened. The gadget sat cryptically on the big shot's desk, buzzing. Twill himself crouched limply in his chair, glaring at the device. About every three minutes he jerked, went white, and slowly recovered.

Van Damm yanked out his pistol. "Get me an acetylene torch," he snapped, and advanced on the gadget. It slid toward Twill, and the troubleshooter, circling swiftly, fired. He missed. The gadget rose, hesitated, and then bored down through desk, drawers, carpet, and floor, vanishing with a diminishing buzz.

Twill mopped his face. "What was it?" he managed to ask. "Luxingham? I thought—"

Van Damm looked at Harnahan, who gulped and explained. "We'll destroy it now, though," he finished. "A torch would melt it easily—it isn't duraloy."

Twill had recovered some portion of his poise. "Hold on," he ordered as Harnahan turned toward the door. "Don't destroy it unless you have to. That might mean blowing up a diamond mine. The thing must be valuable, if only for a weapon."

"Did it hurt you?" Van Damm wanted to know.

"Not—exactly. My heart kept constricting—slowing down with a jolt, and then picking up again, regularly."

"It didn't affect me that way," Harnahan said.

"No? Well, if you've got to destroy it, all right. But don't do that unless it seems absolutely necessary. Thor was a smart robot. If we can find out the purpose of the thing—"

Outside, Van Damm and Harnahan looked at each other. Twill was absolutely right, of course. The gadget might be immensely valuable—if it were only possible to learn how. Its appearance was no clue. It had burned through metal, but a torch could do that, or thermite. Its subtle radiations had affected Twill's heart. That led up a blind alley. The gadget couldn't have been created solely in order to render Twill uncomfortable.

It was uncontrolled, not uncontrollable. Yet only Thor had known the reason for building the gadget in the first place.

"We can see what side products it has, and find out if the sum of the parts equals the whole," Harnahan said. "That would be one way of finding out what the whole is."

Van Damm was fumbling with a hall televiev. "Wait a minute. I want to find out—" He spoke sharply into the mike. Presently he groaned with heartfelt misery.

All the clocks in the plant had stopped. All the delicate instruments were out of kilter. According to the seismograph, a violent earthquake was in progress. According to the barometer, a typhoon was raging. And, to judge by the actions of the atom smasher, all matter was rather impossibly inert.

"Planck," Harnahan said wildly, clutching at a futile straw. "Improbability factor. It reverses the laws of probability—"

"Keep a grip on yourself," Van Damm advised. "You'll be counting your fingers next. We're dealing with cold, logical science. Once we find the key, it'll be as simple as *pi*."

"But we don't know the possible scope of a robot's mind. It might have created anything—something far beyond our understanding."

"The chances are it didn't," Van Damm said practically. "So far the gadget hasn't done anything impossible, in the light of present-day scientific knowledge—"

The televiev chattered hysterically. All the men in Research B-14 had turned into skeletons, and then vanished completely. The gadget had been there, of course.

"X rays," Van Damm said, a bit hoarsely. "I'm going to get that torch, just the same. I'll feel safer."

By the time they had secured the weapon, they learned that the vanished men had reappeared, unharmed by their experience. Meantime, however, the gadget had visited Personnel, frightened a secretary into conniptions, blacked out the fluorescents, and removed the gravity of a huge safe so that it hung from the ceiling, amid crumbling shreds of smashed plastic.

"Now it nullifies gravity," Harnahan said bitterly. "Just try co-integrating that into the pattern. So far we know this: the gadget nullifies gravity, makes people invisible, stops electric power, and gives Twill a heartache. All it spells to me is nihilism."

"Definitely it's getting worse," Van Damm agreed. "We'll have to catch it before we can

even turn the torch on the damn thing." He headed for a dropper, hesitated, and used the nearest teleview. The news was not encouraging. The gadget had got into the commissary and soured all the milk.

"I'd like to let it loose in Luxingham," Harnahan said. "It'd wreck the joint—Lord knows it's trying to wreck *us!* If we only knew how it could be controlled!"

"Telepathically," Van Damm suggested for the second time. "But we don't dare try it. Judging by what the gadget's done already, it'd blow the county into neutrons if we . . . ha! . . . *controlled* it."

"Maybe only a robot can control it," Harnahan said, and snapped his fingers sharply, his face brightening. "Wait a bit! I've got an idea—Thor II!"

"Eh?"

"The second robot built on Thor's model. He's all ready to go—all finished, with a mental library installed. He just needs energizing. That's it, sure. We can't figure out what the gadget's for, but another robot like Thor could. It's perfectly logical, isn't it?"

"Slightly too much so," Van Damm said hesitantly. "Suppose Thor II turns the gadget on us? It might be a device to make robots the supreme ruling species."

"You're the one who's talking crazy now," Harnahan said. He used a teleview to issue orders, and turned away, grinning. Within fifteen minutes Thor II would be in working order, intelligent and ready to cope with any problem.

That quarter of an hour, though, was an unpleasantly hectic one. The gadget, as though demoniacally inspired, tried to visit each separate branch of the gigantic plant. It changed a valuable shipment of gold ingots into dull, comparatively worthless lead. It neatly stripped the clothes from an important customer in the upper tower. It caused all the clocks to begin working again—backward. It revisited the wretched Twill, giving him another heart attack, and causing him to shine with a vague, purplish glow which did not wear off for more than a month thereafter.

It was a goblin, a Puck, a will-o'-the-wisp. By the time the fifteen minutes had elapsed, the Company was in a greater furor than the last time Luxingham had sent bombers over the towers. Long-distance teleview lines hummed frantically. Twill screamed explanations and curses at his partners in New York and Chicago. Technicians and trouble-shooters collided with one another in the halls. A helicopter hovered above, ready to shoot down the gadget if it tried to escape. More than one member of the Company wished to Heaven it *would* try to do just that.

Erratic, unpredictable, and nerve-jolting, the gadget sailed merrily on its way, actually doing very little harm except to upset the entire organization of the Company. Harnahan chewed his nails till Thor II was ready. Then he hastily collected the robot and took a dropper to join Van Damm and his torch on a lower level, where the gadget had last been seen.

Van Damm sent a sharp glance at the robot's face. "He's conditioned and ready?"

"Yeah," Harnahan nodded. "You know what we want, Thor II, don't you?"

The robot said, "Yes. But without seeing the device, I cannot tell you its purpose."

"Fair enough," Van Damm grunted, as a screaming blonde fled past him. "It's probably in this office."

He led the way. The office, naturally enough, was deserted, but the gadget, buzzing faintly, hung in midair in the center of the room. Thor II moved past Harnahan and stood intently regarding the cryptic machine.

"Is it alive?" Harnahan asked softly.

"No."

"Its purpose?"

"Wait. To solve a problem—yes. I do not know if it will solve the problem for which it was created. There is only one way to tell."

Thor II stepped forward. The gadget swung around so that the lens faced toward him. Some instinct warned Harnahan. He heard the buzzing grow in intensity, and simultaneously hurled himself at Van Damm. The two men crashed down

behind the desk, the trouble-shooter's portable torch clattering heavily against the wall and falling painfully on Harnahan's legs.

He scarcely felt it. Other things were happening. A lambent, pinkish ray fingered out from the gadget's lens and bathed Thor II. Coincidentally, the buzzing rose to a shrill, nerve-racking whine which did not last long. It ended in a blasting concussion that blinded and deafened the two men and knocked the desk on top of them.

Harnahan coughed rackingly and mumbled something. Somewhat to his surprise, he was still alive. He got up in time to see Van Damm staggering forward, holding the torch, and playing a blazing flame toward the gadget, which made no attempt to escape. It glowed crimson—and then began to melt. Globules of copper and other metals dripped down on the floor. With a dull thump the gadget—what was left of it—dropped, harmless and insensate.

Van Damm turned off the torch. The low buzzing had stopped.

"Dangerous," he said, looking wildly toward Harnahan. "Got it just in time. You hurt?"

"Just in time!" Harnahan said, pointing. "Look at that!"

Van Damm looked. Thor II had suffered the fate of Thor I. A broken machine, he lay half melted near the door.

Harnahan drew his arm across his cheek and looked at the blackened stain. He leaned on the desk and a slow grin grew on his face. Van Damm watched in amazement.

"What the devil—"

Harnahan was laughing almost hysterically. "It . . . it worked!" he managed to get out. "What a . . . what a shock for the Company! The gadget—worked!"

Van Damm gripped the engineer's shoulders and shook him. Harnahan sobered, though a wry smile still quirked his lips. "O. K.," he said at last. "I . . . I couldn't help it. It's so funny!"

"What is?" the other demanded. "If you can see something funny about this—"

Harnahan gulped. "It—well, it's a deadlock. Haven't you guessed yet what the gadget was for?"

"Death ray of some sort?"

"You missed the point of what Thor II said—that there was only one way to tell whether the gadget could do what it was intended to do."

"Well? What was that?"

Harnahan giggled feebly. "Logic—use logic. Remember the first robots we made? They were all sabotaged, so we built supposedly indestructible ones of duraloy. And the robots were made to solve problems—that was their reason for existence. Everything went along swell until those robots went crazy."

"I know that," Van Damm said impatiently. "What's it got to do with the gadget?"

"They went crazy," Harnahan said, "because they were faced with an insurmountable problem. That's elementary psychology. Thor I faced the same problem, but he solved it."

Slow realization was dawning on Van Damm's face. "Indestructible—no!"

"Sure! Sooner or later, all the duraloy robots thought of a perfectly obvious problem for them—how they themselves could be destroyed. We made 'em that way, so they'd more or less think for themselves. That was the only way to make them satisfactory thinking machines. The robots buried out in the cement faced the problem of their own destruction, couldn't solve it, and went crazy. Thor I was cleverer. He found the answer. But there was only one possible way to test it—on himself!"

"But . . . Thor II—"

"The same thing. He knew the gadget had worked on Thor I, but he didn't know whether it would work on *him*. Robots are coldly logical. They have no instinct of self-preservation. Thor II simply tried out the gadget to see if it would solve his problem." Harnahan swallowed. "It did."

"What are we going to tell Twill?" Van Damm asked blankly.

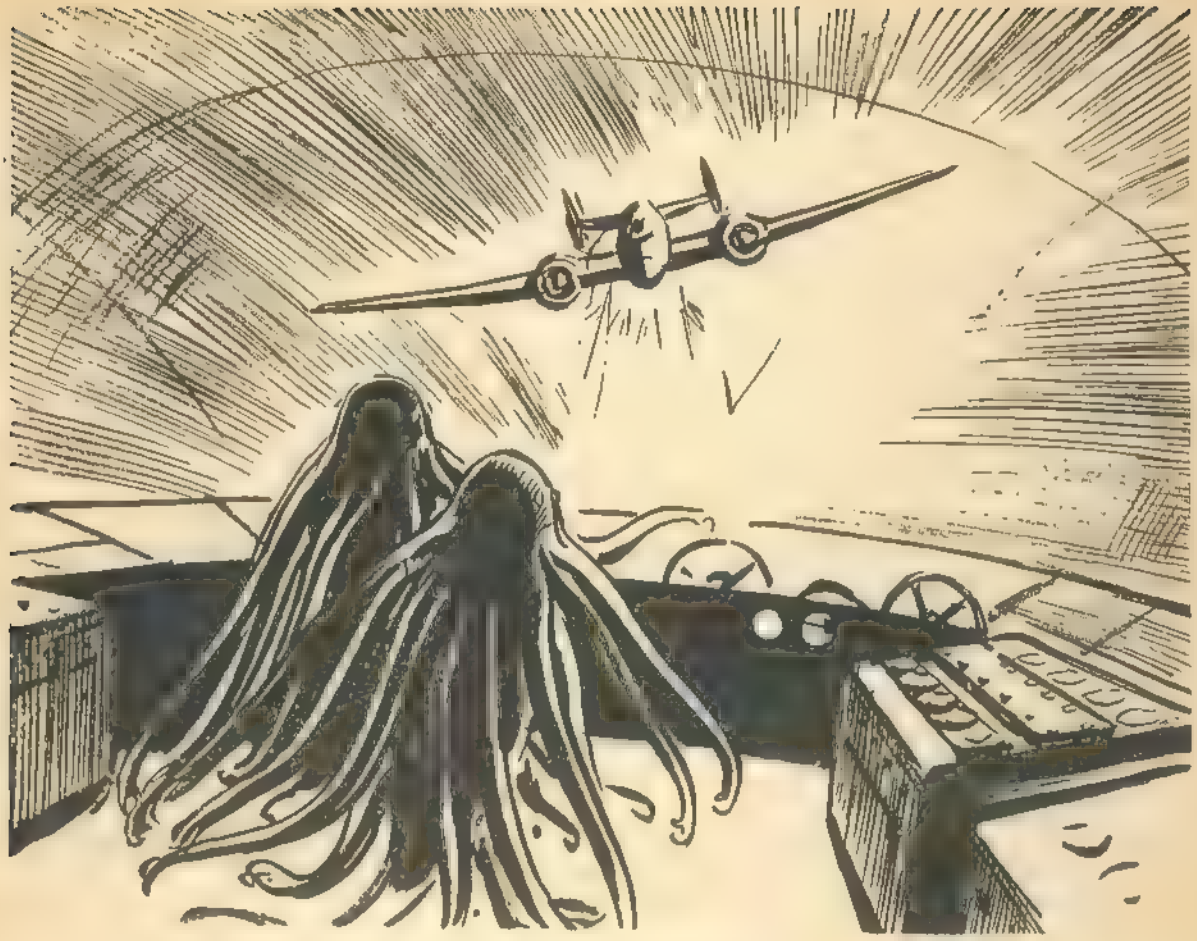
"What can we tell him? The truth—that we've run into a blind alley. The only usable robots we can make are duraloy thinking machines, and they'll destroy themselves as soon as they begin to wonder if they're really indestructible. Each one we make will need the ultimate proof—self-destruction. If we cut down their intelligence, they're useless. If we don't use duraloy, Luxingham or some other company will sabotage 'em. Robots are wonderful, sure; but they're born with suicidal tendencies. Van Damm, I very much fear we must tell Twill that the Company's run up a blind alley."

The trouble-shooter groaned. "So that was the real purpose of the gadget, eh? And all those other manifestations were just by-products of an uncontrolled machine."

"Yeah—" Harnahan moved toward the door, skirting the half-melted remains of the robot. He looked down sadly on the ruined creature and sighed.

"Some day, maybe, we can do better. But right now it seems to be a deadlock. We shouldn't have called him Thor," Harnahan added, as he went out into the hall. "Somehow, I think Achilles would have been more appropriate."

THE END.



JACKDAW

By Ross Rocklynne

● **The beings of that strange world liked puzzles; they liked logic. But the puzzle of the ruined civilization, with but one living man left, involved something they could not comprehend. They were logical.**

Illustrated by Schneeman

When Belgarth arrived back on the home planet, Emonso, with his crew and galactic-roaming ship, he felt that he had a first-order intellectual riddle to discuss with his sectional recreation governor. If the problem were indeed next to being unsolvable, he was aware that not only would he add considerably to the recreational facilities of his race, but would also put himself up for prompt promotion.

Belgarth did not trouble to act in his capacity as captain when the ship hove in sight of the home port, but delegated the automatic job of landing to his subordinate officer, and immediately took wing for his commander's offices.

"Took wing" does not convey the method of his departure and eventual arrival. To be truthful, he selected a sixth-dimensional route which, as far as he was concerned, turned his giant ship inside out, scrambled it unrecognizably, but left him most indubitably on the outside, looking down on a similarly twisted caricature of a city.

Looked at from such a convolution of space, the

city was a riddle, even to Belgarth. Which is a good commentary on the mental processes of Belgarth and of the Emonso, that wise race of the universe, other than which there is none older, other than which none shall exist longer.

Belgarth proceeded to figure it out, his many eyes winking in series of five, seven, and nine, as he turned off certain mental operations whose supplied data were immaterial to the problem at hand. The small cube which stood on one corner at the southwest end of the city must, naturally, be Main Street—in a sixth-dimensional matrix. Since Governor Orth's bubble palace was at Main and Omono, Belgarth need but follow a path indicated by the topology of a five-dimensional cube two dimensionally imposed on practically any three-dimensional geometric figure.

Which he did with a great deal of ease, wishing meanwhile, and with some disappointment in the facility of the solution, that he had taken the time out to set his synapses into a pattern which would have permitted the somewhat more complex eight-dimensional path.

Governor Orth—thoroughly three-dimensional—untwined the several sinewy sections of his body from the chair behind his desk, and focused several of his eyes on Belgarth as he materialized.

"Oh, you, Belgarth," he said in slightly annoyed tones. "Always bothering a person, and without the least excuse. Have a good time? Never mind—that problem you posed on your return from your last expedition was a sheer washout as far as the Research Corps was concerned. They figured it out in nothing flat. If you must bring in problems which solve themselves, have the care to add your own elaborations—at least we can have some fun proving the elaborations are such. What's on your mind this time?"

"Plenty," said Belgarth. He settled himself comfortably around a chair, selected half a dozen cigars from Orth's humidor, and fitted them into his several mouths. He began to blow concentric smoke rings, his main eyes thoughtful. He began to talk. "I've had my ups and downs, governor. You know that. Through a lucky break I came out of the Upper Level Research Corps to command of a Recreation ship. I happened to hit on the solution of a problem our whole race had been working on for some million years, and you personally, off and on, for over ten thousand years. My luck with a command netted a few puzzles—the peculiar relationships of gravitons to chronons for one, which, of course, was cracked, but only after a thousand years of concerted effort from the entire Third Level Corps. Good enough. And, of course, I brought back a few flops—the one you mentioned just now, warped time, which I understand wasn't a problem at all.

"But, like all Recreation ship commanders, I've rather been looking forward to finding something that would give the whole Emonso some recreation that would endure for an indefinite length of time. *That* would be a contribution!" he added feelingly, and paused.

Orth frowned uncertainly at him. "You've found it?" he said cautiously.

"I think I have."

Orth said slowly, "I see." He pressed a button which actuated a sixth-order field that would retain the conversation from this point on. He settled a little more compactly around his chair. "We can discuss it now, Belgarth—you have the data, with suspense, emotion and factual material well correlated?"

Belgarth was surprised. "You don't prefer a semantic account?"

"Not at all." Orth's reply was definite, if bitter. "Facts and figures are killing me, Belgarth, *killing* me! My ship commanders seem to have forgotten entirely the unformularized psychological aspects of certain situations and events—the least they could do would be to include them as errata, for later correction and elimination—it would give *life* to a problem. But go on, go on, Belgarth, and draw it out as long as you wish—my next thousand years are yours, if you make it good."

Belgarth nodded in sympathetic understanding and immediately plunged into his tale, from which the major quotes have been mercifully eliminated:

On the fourth day of the one hundred third year of our tenth cruise we found a solar system. We were all exultant, and as speed was braked, I ordered a celebration. After all, when for year after endless year, for star after star, for light-year after light-year, you don't run across something which is likely to result in a problem, it gets pretty monotonous. You know and I know that there are a thousand and more different ways in which solar system can evolve—all of us suspected that this system, with nine planets instead of the usual fifteen, would present a different solution.

After the celebration, I got my computers busy taking readings. We did find some interesting things, which will be noted only in my written report; however, the secret of the system's formation was no secret at all. Six of its planets had been swept away following the original nebula-star-nebula mix-up—swept away by a double star some four and a half light-years distant. So, save for a rather unusual disfiguration of the add-four law, this system was like any other of its class.

Choe, my main computer, swore. I agreed with him, but of course was powerless to relieve the disappointment of my crew save by agreeing upon a landing on one of the planets. All of the planets, save one that was ringed, and another beyond it, were more or less habitable, so I gave my crew their choice. They took a vote on it, and surprisingly enough were unanimous in that they picked out the

third planet from the central sun. I noted at that time, by the way, governor, that this planet as seen from space was blue—or, rather, azure. Sometime I intend to find out exactly what emotional effect that color has on the Emonso—it certainly has one—give it to one of the Minor Corps, sometime, if I don't get around to it.

So we did land, after making one slow revolution around the planet at a distance of several hundred feet. We brought the ship down on the shore of a salt ocean. A ruined city—that is, its main sections, rose some ten miles away. We were on the outskirts, deeming that best, since, if there were inhabitants in the city, we did not wish to frighten them too much.

We were all a little more excited than is usual in landing on a planet. For one thing, life in this universe which the Emonso alone have troubled to explore, is rare. We had, in our slow circuit of the planet, discovered cities, roads and cultivated lands—sure indications of life. For another thing, we were all of us certain, down to a man, that the life which had built those cities was on the wane, if not completely gone. What had caused it? A blight, or a natural death such as might come with what we of the Emonso still recall as "old age"?

A great, complete silence brooded over this planet.

Still, we did not wish to believe that that silence *was* complete. We wanted to observe. We allowed our opinions to remain theoretical. I ordered out half a dozen scouting ships, with the stern injunction to touch nothing, no matter what happened.

As it happened, my own command was more applicable to me than to the others. Choe and I took one of the scout ships, Choe at the controls. We sped directly east, away from the ocean, maintaining a discreet height above the planet's surface.

It was an interesting planet. This particular section, a thousand miles of it, was rather mixed up physically. There was the strangest conbination of mountains and snow and lakes and deserts and vast forests, with cities now and then, ruined, churned cities, but cities nevertheless.

As we progressed east, cities and roads became more complex, better constructed, and more numerous. But the cities were more thoroughly demolished. We saw no moving vehicles, no signs of intelligent life at all. Now and then, however, we saw herds or packs of animals who were, respectively, the hunted and the hunters.

We came to another ocean. After some three thousand miles, we sighted a continent with some islands hugging its outskirts. The islands had been inhabited, but the evidences of civilization were completely leveled. On the continent proper, cities and farmlands were crowded together unsymmetrically. We could not see them in detail, since we were too close to them and moving too swiftly. Yet, we did note that destruction had been applied here, also. These cities were debris, the debris of a holocaust whose nature we seemed emotionally unfitted to conjecture about.

"There!"

Choe's ejaculation burst out at the very moment we had fixed our minds into a pattern which expected lifelessness. We jerked ourselves from that state of mind quickly. In the next few minutes, we made up our minds that life, intelligent, tool-building life, was present.

The creature who operated the craft must have seen us from the distance, for he came flitting up from the heart of a city ahead of us, and had matched our altitude by the time Choe saw him. He was coming straight toward us, the Sun burning with a hot brilliance against the wings of his strange vehicle.

I say "strange" advisably. Not because I did not understand its method of locomotion immediately, but because we of the Emonso are and have been so used to such simpler means—dimensional transit, operated mentally over comparatively short distances, or the light-beam heterodyning and rocket principle combined. This craft swam in the air by means of solid propellers, and buoyed itself up with plane surfaces projecting from the main body of the ship. Nonetheless, it was fully capable of matching our present rather slow velocity—which it did not have to do, since it was in our direct line of flight.

As we approached closer, we noted an unusual exhibition on the part of the alien craft. Rings of fire were spouting in intermittent blasts from its nose. Above the rumble of our ship's jets, we heard a chattering—a sort of *rat-tatting* sound. And as the ship neared us, its motors thundering, we definitely heard the sound of small metal pellets striking against our transparent foreplates. I shivered a little, thankful that those foreplates were capable of deflecting spacial flotsam driven with full meteoric velocity.

Choe was tense, uncertain. "I'd better change course, Belgarth! We'll crash into each other."

"Maintain course," I snapped back. "The inhabitant of the airplane will certainly have the courtesy to veer off, since he must realize that we are the visitors, not he."

It happened in the manner I predicted. The plane was almost on us, the peculiar chattering still emanating from it, when its motors crescendoed, and it swept directly over us with inches to spare. We did not change course, but naturally I had actuated a sixth-order field which gave us a still-life picture of the being. Both Choe and I were somewhat puzzled over the unusual behavior of the creature, and thought it best to study him, his

structure and general appearance, so that we could correlate the data later on, and thus acquire the correct visitor's approach.

Choe had touched the electron lock, and the picture was draining off onto the screen, when we were aware that our visitor was not yet done greeting us. His plane buzzed around our craft, dipping, diving, chattering; we heard the spang of hard-driven pellets striking against the impervious bulkheads. Finally Choe and I decided that until we grasped the psychology of the inhabitants, it would be wise to let a friendly meeting go until another day. Our ship put on a burst of speed which, rather uncivilly of course, left the other ship far in the distance, soon to disappear.

Then we turned back to the life-size picture of the creature.

He was strange, naturally; but then we would doubtless have been strange to him. First of all, his external appendages and organs went mostly in twos. Two eyes, two ears, two arms, two legs—but only one mouth; which, if you can twist your mind around, governor, is not absurd at all—in fact, our *eight* mouths are, in a way, the real absurdities. However, this being had hair on its head, part of which fell over its forehead. It was dressed in stiff khaki garments, on the coat of which gleamed several pieces of designed metal which I conclude must have been for ornamental purposes. The shoulders, which were in reality rather narrow and sloping in proportion to the broader hips, were given an artificial squareness by padding in the upper garment, the general effect being aided by little brushes of gold string projecting from the shoulders.

So much for a general description. The being used artificial means to enhance its personal appearance, and therefore was probably vain. We now studied the facial expression. Certainly, neither Choe nor I, though we leaned backward in an effort to give the creature its due, could find any trace of pleasantness. The muscles of the ovular face, we decided, when relaxed would give the skin a fairly smooth appearance. However, these muscles were not relaxed. The mouth, for one, was contorted, and the eyes were slits. The general effect of this was an unnatural formation of tight little hollows beneath the cheekbones, and unattractive shadows in the corners of the lips, in addition to an unsymmetrical bulge of muscles along both sides of the face.

We drew the picture back into its field, and stored it away for future reference.

"What do you make of it, Choe?" I demanded.

"The creature was ill," Choe said positively.

Such was my opinion, governor; at least it was a good-enough opinion to hold until we met more of the beings.

We arrived back at the ship in a state of excitement. In the remainder of our four-day trip, we met no more inhabitants. Indeed, it was hard to believe that people could live in the rumpled terrain, the ruined cities which we saw from the air. However, we were sure that at least one of the other scouts had seen indications of human life.

On the contrary. Instead of gathering data of that nature we were the only ones able to give it. We had to tell our story over and over, for none could make head or tail of the creature's actions. We searched backward in our experience for something corresponding to the rain of pellets which had smashed against our bulkheads. Certainly, we reasoned, the creature must have known that the pellets would not penetrate to the interior of our craft, since that would have damaged our bodies. Therefore, he must have been saluting us, or perhaps starting up some system of communication which, according to his psychology, we should have understood easily. We all regretted profoundly that we were unable to see inside the creature's mind. We felt that we would have made some unusual observations, and perhaps been able to render some much-needed assistance.

In the following days, we made additional scouting trips, taking slightly different routes. Only one of the scouts reported anything out of the ordinary. He was met, somewhere in the eastern hemisphere in north temperate latitudes, by a great fleet of planes. It was quite an exhibition. The scouting ship was thrown about a bit by some spectacular explosions which occurred in the air about. The planes were evidently dropping tokens of some sort which were timed to explode either on the ship or around it. Some of the planes, their pilots seemingly in the grip of some overwhelming emotion, lost control of their ships, smashing themselves against the scout ship. It was a rather dangerous display, and the scout ship outdistanced the welcoming horde, not even taking the time to secure pictures.

We all decided that the peculiar behavior of the inhabitants would be a hard nut to crack. We had landed in a civilization which was definitely and without question entirely foreign to anything we had ever seen or heard of before. Feeling that we might unintentionally be violating some law of courtesy by not returning the enthusiasm with which we were met in like manner, I no longer sent out scouting ships, but confined operations to a fifty-mile isosceles triangle of which our ship was at the apex.

The city we explored in that general area evidently had been an important one. It was built around a bay, from the waters of which projected the hulks of sunken ships. Destruction was widespread. The buildings, unlike those of the eastern cities, were not high. Nonetheless, since that city belonged to the same civilization, we thought its

contents should be a satisfactory index to the contents of other cities.

Some of the buildings, by the variety of implements in them, we identified as living quarters. We found immense quantities of food incased in metal and glass containers. The people evidently found the preparation of their own meals a more efficient method than distribution from a central kitchen. Furniture and rugs and other appurtenances to living were luxurious in quality. We did not err in believing that this was a wealthy civilization. Why the greater part of it had been destroyed we could not begin to conjecture. There were no people, but if there had been, a group of a considerable number could have lived indefinitely on the foods and in the homes and buildings whose interiors were still intact.

We followed streets which were heaped with the debris of wrecked vehicles.

We found airports—and these seemed to have been visited with greater destruction than the cities themselves. There were airplanes, but they had been twisted and torn apart until they were almost unrecognizable.

At the end of our third day of exploration we grew depressed.

As Choe said, despondently, "So many great things—so many valuable things—but utterly useless without someone to use them. Useless."

We pursued a quick four-dimensional route back to the ship, arriving on the interior to find the crew in a state of wide-eyed excitement.

"Ships! Thousands of them!"

The general cry was true in its statement, as I soon noted. From the west, the very sky was darkened with the numberless planes which were sweeping toward us. And truth to tell, I was relieved. At last some of the puzzles with which we were faced would be solved. A delegation from the remnants of the people had come to welcome us. This time they would land. This time they would seek a more basic method of communication, forgiving us whatever transgressions we had made on courtesy.

Of course, I was wrong. Very wrong.

The explosions began to occur. The planes swooped, motors roaring. Missiles began to strike against the ship. I at once ordered those few in my command who were outside the ship inside. They came quickly, for geysers of rock and earth had commenced to rise near them.

It was awesome. Ship after ship, in solid, unswerving lines, roaring down from the blue vault of the sky, loosing their explosive tokens. The very ground around us became pitted, corroded, churned. The ship shuddered under the concussions, but, of course, nothing was damaged. However, craters were opening around us, rendering the foundation on which the ship stood unstable. I caused the ship to be lifted slightly, intending to place it in another spot, until the enthusiasm of our visitors wore itself out.

It was hard to land. No sooner were we in the air than we were literally enveloped by hundreds of flying ships. We were afraid of damaging them, they were so numerous. However, our upward motion seemed to make them more intense. The ships began to crash in unending streams against our bulkheads, deliberately throwing themselves against us, absolutely and completely destroying themselves as they exploded into flame. We hastily landed—and so the strange exhibition continued, all through the long day.

My story, governor, is so far unbelievable. What I have yet to tell, flatly contradicts common sense. Briefly, after each ship had rid itself entirely of its explosive tokens, it climbed to a dizzying height, poised, and then came roaring down. At the full top downward speed of which it was capable, and with an accuracy of aim which was commendable, these ships would hurtle directly, and without hesitation, at our ship. The scream of its flight would be cut abruptly. A staggering crash, the ship shudders a little—and that was the end of that plane.

The sun was almost obscured by the horizon formed by the great salt ocean, when the final note in the senseless drama sounded. All this time, we had had our radio receptors on to the all-wave length. Nothing had sounded. Now a voice began to speak. Of course, we could not understand. But we all breathed with relief. Proper communications were starting. We all preferred to overlook the holocaust that was still being enacted outside the ship. For of all those thousands of ships, the last ten were at that moment in full downward flight toward us. In another ten seconds, they had demolished themselves. And far up in the sky, limned darkly against the blue, the dark shape of one lone airplane circled.

From that ship, the voice was coming.

We listened eagerly, hoping to understand some inflection of tone. Hoping to gather some clue which would inform us of the correct method of procedure we were requested to follow. Unfortunately, the voice was not understandable in any of its phases. It was *not* a melodious voice. It grated on our nerves. The words were spoken at what must have been the full power of the being's lungs. Sometimes it dropped to a roar, jerked itself upward to a high-pitched scream, dropped downward to a tearful sob and then swept upward to so shrill and bestial a sound that all of us automatically closed our auditory centers.

Still, there was *something* hypnotic about that voice!

We were fascinated. The voice was, to our senses, of course, a poison with which we were

enthralled. The sensation, remembered now, makes me shudder. The longer we listened, the more we disliked the horrible, insidious rhythm. At last, I ordered the receptor shut off.

Our nerves relaxed. It was good to hear the quiet. But then the sound of the airplane above us again became audible. We glanced up through the hull, which I had caused to become transparent.

One of my lieutenants said lowly, "I fear the worst, Belgarth."

So did we all. And the worst happened. The plane was a three-motored affair, by far the largest of all the horde which had destroyed itself so senselessly. It began to descend, and when still an appreciable height above us began to loose its tokens. The reverberations seemed to shake the world. Spouts of earth geysered upward, and our ship shook from stem to stern. On that one downward dive, the pilot of the ship must have entirely emptied his ship of explosives, for he zoomed away —and the next time came at us with but one intention in mind.

To hurl his ship against our impervious flanks, exactly as the other thousands had done.

He came dropping from the sky. We heard the chrilling scream of his passage. Another second and— We all gasped.

In contradistinction to the actions of the other ships, this one swerved, made what seemed a desperate attempt to avert disaster. It did escape direct collision, but its wheels scraped us. The craft turned head over heels, struck the ground at a low slant, tumbled over the gouged surface for half a hundred yards, and slumped to a stop.

When we got there, and pulled the pilot from the plane, which burst into flame but a moment later, he was dead. A metal lever, which we judged afterward must have steered the ship, had plunged clear through his body.

Choe and I cast each other one astounded glance.

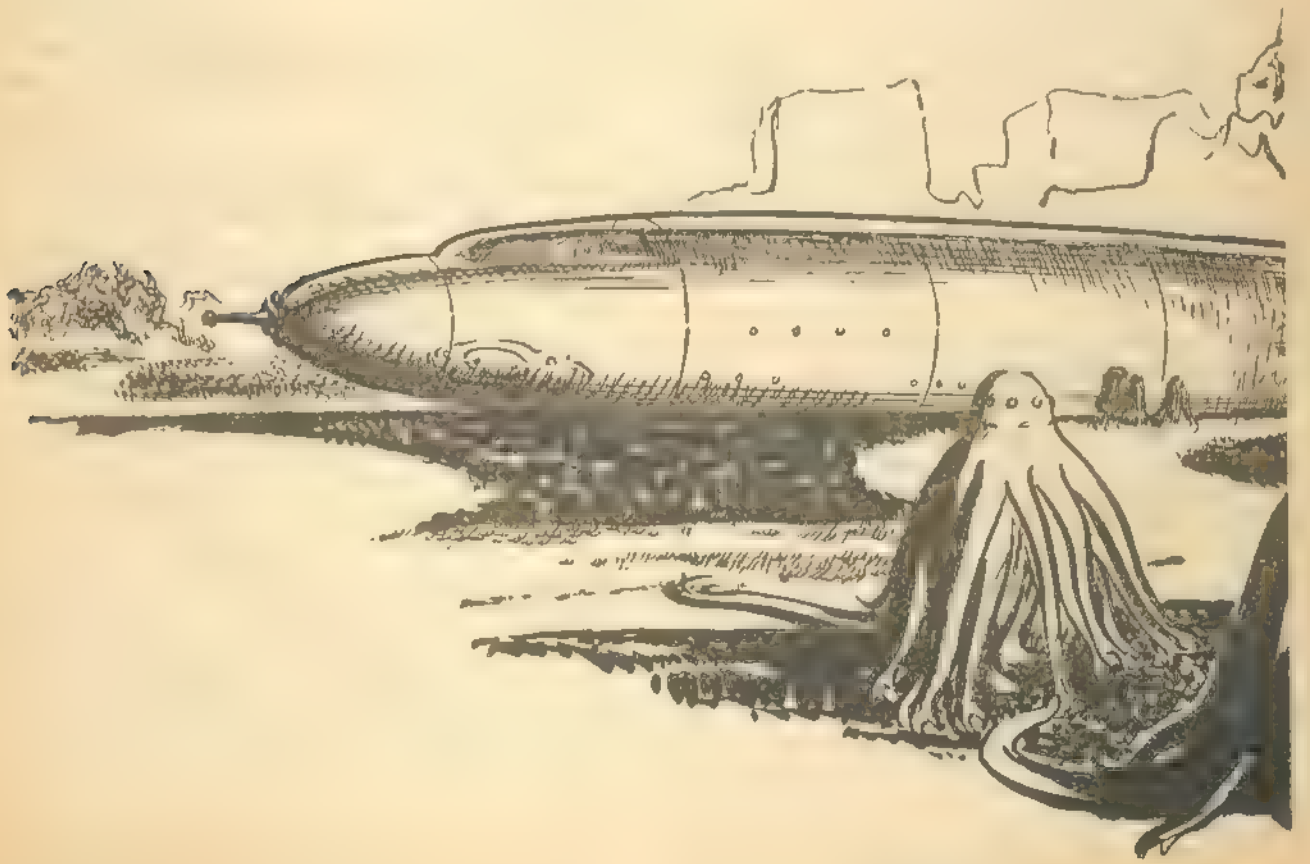
This creature was the same we had seen on our first scouting trip!

Furthermore, he was—had been—the only intelligent living creature on the planet at the time of our arrival.

Belgarth fell quiet for the first time since he had started his story, puffing abstractedly on the butt of his last cigar, using the mouth he had been talking with. As abstractedly, he noticed that the shiny, curved walls of Governor Orth's office were shrinking and expanding. "What's that?"

"That's the children," said Orth impatiently. "Never mind them. They're blowing a new room—the pressure of their bubble is affecting this one. Go on with the story— Say, are you sure you aren't elaborating?"

"I assure you I am not."



"The denial may be an elaboration in itself. Never mind—only I didn't want you to take me too literally. This story can stand by itself."

"It can," said Belgarth in satisfaction. "However, governor, there isn't much more to tell. We searched the scene of the holocaust which had taken place around us. Hundreds of the planes were merely shattered. We searched inside them and found *nobody*. With which data we rightly concluded that none of the planes had been personally piloted. They were robot planes. They had been operated by our dead being. He had kept his plane well out of the exhibition, by means of a complex instrument board directing the other planes in their spectacular show.

"And wasn't it reasonable to suppose that since the one intelligent being we had seen had also turned up directing that horde of ships, that he was also the only intelligent being alive on the planet? Such was my conclusion, and that of my lieutenants. Nonetheless, we did not rely on reason and intuition alone, governor, but organized ourselves in such a manner that we could completely comb that planet, from north to south poles, from east to western hemispheres—comb it *thoroughly*.

"Which we did. It took us one full year to do it, using every man and every device at hand for the job. When we were finished, we were satisfied, beyond a shadow of a doubt, that the planet was completely devoid of intelligent life; that but one creature, who now lay frozen in the refrigeration

chambers of our ship, had inhabited it at the time of our arrival.

"We pulled up stakes and came back to Emonso, satisfied that we had found a real problem for the Emonso to play with. Briefly! What is the intellectual shortcoming, *in us*, which prevents our being able to comprehend the mental processes which motivated that single intelligent being's actions?"

The problem had already occurred to Governor Orth, in the specific form in which it was stated. He absently detached from the stalk which projected below his fourth eye a gleaming, spheroidal jewel—faceted minutely, if one were to look closely—and began to rub it back and forth on his velvety skin. Belgarth, watching him, knew that he was thinking, and thinking most profoundly. He repressed a multiple smile. Sagely, he was aware of Orth's next question before it was uttered.

"You collected no more data?"

"None. I suspected that you would prefer to be among the first to participate in a possible solution. You wish to eat now?"

"Now," and the machines which dutifully translated their two telepathic commands—machines which reposed at the core of the planet Emonso—spread Orth's desk with a repast on which the two creatures at once fell.

Then, "Take me to see this being," commanded Orth, and Belgarth led the way along a simple three-dimensional route, for he knew that Orth needed much time to think. They found a small ship on the street where an Emonso had left it, climbed in. Belgarth took over the controls. They rose over the shimmering city, the bubble-houses contracting and expanding with each minute change in atmospheric pressure. Then they were slanting down toward the landing field where reposed the giant cylinder which Belgarth had brought back from a section of the universe that was far and away beyond the visible stars.

Orth stood looking down at the frozen being. "A strange creature," he commented. "How did he compare with others of his kind—that is, surely you found sample skeletons?"

Belgarth was vaguely surprised, and also impressed. That Orth should have directly impinged on a subject research into which had netted Belgarth a singular fact, was a favorable commentary on Orth's acumen. Yes, Belgarth admitted, he had found sample skeletons—his crew had collected a few hundred which had immediately been classified into child, male and female groups. All, he went on, were pitted and corroded in a most unusual manner, so irregularly in individual cases that one could guess at the agency of either diseases or corrosive forces. Belgarth expressed his opinion that this peculiar skeletal characteristic was a marker which might point the way toward a solution of the manner of death of the beings.

"But the average dimensions," exclaimed Orth impatiently.

Belgarth looked at the still, frozen white face. He felt slightly uneasy. He had come to Orth with a problem which he truly felt to be beyond solution. He expected a rise in rank from his work in presenting the various ramifications to the Emonso, whose sole purpose in existing was the exercise of the intellectual centers of their large brains, which was in one word, recreation. Yet Orth had directly put his finger on a peculiarity of the situation which Belgarth had come across purely by accident. Therefore, Orth must be working from a preconceived, and therefore precedented plan. But where, in all the universes which stretched endlessly through the cosmos, had there been a precedent for the thoroughly confounding incidents which had occurred on Sol Three? He reluctantly told Orth that the male being at which they looked was distinctly slighter in build, both longitudinally and laterally, than the average adult male.

He added apprehensively, "You have discovered a fundamental on which to build factual, eliminatory, correctional and suppositional data?"

"Naturally," snapped Orth, thoughtfully placing his spheroidal jewel back on the stalk from which it had come. "It is fundamentally necessary to find the relationship of the nucleus of the problem to its environment. The environment, in a large sense, is the universe. In a restricted sense, it becomes that environment which is in direct contact, or the most direct contact, with the nucleus. This being is the nucleus of the problem. We must discover his relationship to others of his kind, both physically and psychologically."

Belgarth was relieved. "That fundamental applies to any problem."

Orth went on. "Psychologically, we are completely in the dark. Our minds move—or moved—in different orbits. However, the different exterior physical relationship is so pronounced that I believe we have discovered what may well be one of the most important—if not the most important—indicator toward a solution. How far we shall progress with it remains to be seen.

"Our information so far is almost completely negligible in quality. Briefly, we are certain *what* the creature was. He was an intelligent being who was the sole inhabitant of a world on which once lived other intelligent beings. It is a logical certainty that he lived at least part of his life rubbing shoulders with others of his kind, since it is an absurdity that he was the product of spontaneous conception. Therefore, he was present when the civilization of which he was a part met its doom. How he was affected by that, what part he played in it, come under the heading of *who* he was. If that information comes adequately into our grasp,

we may understand his actions when you and your crew and ship were added to his environment.

"Belgarth," he concluded, abruptly turning away from the frozen enigma, "you will outfit a ship. In addition to the regular crew, you will include half a dozen Upper Level Research Corps philologists who are superior in basic thought pictorialization. You will set the ship's control for an automatic landing in your previous landing spot on Sol Three. During the voyage, we will use the Sleep."

Orth went in one direction, to arrange affairs for his departure. Belgarth went in the other, toward the ship port, faintly annoyed with Orth for plunging so avidly into a problem which Belgarth would have sworn did not have even a foothold for a solution.

The planet Earth swings heavily in its lonesome orbit. It has been millions of years—perhaps a billion—since Belgarth landed his ship there. The cities, the roads, the cultivated lands—all are gone. There is no iota of evidence which could prove that once a race of beings had its inception there. There is no iota of evidence which could prove that once the Emonso landed there. For the Emonso have long since forgotten Earth, even as the record of their own history has entirely been destroyed by the corrosive action of time. They have forgotten the problem which was alone Orth's reason for going there. They have even forgotten that the problem was not solved.

No, not solved; for which the Emonso are entirely blameless. They were an old race, and there were none that were wiser. They were so old that they had forgotten their own beginnings. They were so wise and they looked so high that the millions of years had atrophied something in their minds. The atrophy, of course, was a good thing—but it did not help them to understand.

On that day which again saw Belgarth on Earth, with Orth as his companion, it was spring, and the rains were descending in abundance. The great salt ocean was shrouded in mists, as was the great city which had long ago been built on its shore. Eucalyptus and pepper trees gratefully accepted the offering of the heavy, unemotional downpour.

The great ship landed in the precise spot from which Belgarth's ship had taken off more than two hundred years before. Belgarth and Orth were seated around chairs in the lounge, studying through portable view-plates the land exterior to the ship. There was not much to be seen, and Orth's brow was clouded. Where was the remainder of the senseless exhibition which had taken place? Where were those robot ships which had smashed downward to their doom?

Belgarth was in the grip of a depression. It might have been the aftereffects of the hundred-year Sleep from which he, as well as Orth and the rest of the inhabitants of the great ship, had just awakened. Or it might have been the almost tangible forlornness which swept across the tangled, ruined face of Sol Three. Belgarth was sure it was the latter.

He indicated the gouged, eroded terrain which swept away from the ship. Here and there, like ancient tombs, mounds of earth rose.

"Time has been at work in the two hundred years since I was here last," he muttered heavily. "The very surface of the ground has changed. Those mounds—beneath them lie the ships which hurled themselves against the flanks of the ship. I wonder . . . I wonder what two hundred years has done to the rest of the planet?"

"Probably ruined everything that might have aided us solving the problem," Orth said grumpily. He played with his minutely faceted jewel, his face thoughtful. "I am thinking mainly of the word-records of this planet. What if their books are of the old-style, electric-sensitive, type-filament wire? Climate may have rusted them, or magnetic storms ruined them. Worse still, what if they recorded happenings on an organic material, to be translated optically rather than auditorially? Before you left this planet, Belgarth, you certainly should have gathered books and other exhibits which would not have been ruined by the two hundred years that you knew would pass before we could get back. That was a blunder."

Belgarth was aggrieved. "A blunder! Yet you yourself advocate the complication of a problem whenever possible."

"An oral complication or elaboration, yes. But a complication which physically distorts or destroys the data on which the problem is built is rather like cheating, Belgarth, and is an indicator of childishness—for then one does not discover problems, one conceives them. As you say, this problem is a hard nut to crack—there's no sense in artificially strengthening the hull, is there? One had as well deliberately ignore fundamental factors in the problem in order to prolong a solution."

Belgarth said woundedly, "What will be our method of operation?"

"The philologists, of course, are our only hope of a direct and final answer. They know their business, so we'll let them take their own course, which will first of all be a hasty survey as to whether there is more than one language. Having determined that, they will seek out that language which was most widely used, and proceed to break the various periodicals of current history into basic thought patterns."

"What if," Belgarth interrupted a trifle sarcastically, "those basic thought patterns are not the ones which our minds accept? Remember, we may be the wisest and oldest race in the universe, but even minds may be relative. For instance: We are so old that our own beginnings are unknown.

We do not know by what methods we evolved. Were our primitive ancestors actually concerned only and completely with happiness and recreation? Were all peoples on all inhabited planets driven upward along the path of evolution by a desire to enjoy? We don't know. In all our millions of years of universe exploration, we have never found a really primitive race of intelligent beings. I would venture to say, in fact, that this civilization is as young as any we have ever discovered."

"I don't know what you're getting at." Orth's eyes blinked in progression as he ran his mind over the exact phrasing of Belgarth's speech, striving to extract the kernel of information he was trying to impart. "And what do you mean, this civilization is young? They have complex cities, and appear to have advanced greatly in science—or were you elaborating on that point? And didn't you say the furnishings of the residents were luxurious? That points to a desire to enjoy—Oh, your conclusion, whatever it is, must be ridiculous. Remind me to discuss it with you later. Isn't that downpour incredible?"

Belgarth fastened his attention on the rain. "It's lessening a little."

Orth untwined his complicated structure from his chair. He lighted a cigar and began to move up and down the length of the room. Finally he stopped and pointed his cigar at Belgarth. "Get the philologists moving. Tell them to take their time, but to report back here to the ship whenever they run across a datum which seems to them an important one. They can send their reports telepathically, to be recorded on a sixth-order field, or personally if the datum is unusually applicable.

"Furthermore: Start the crew combing through the city. They are to look for skeletons exclusively, and are to record exact measurements. I want thousands of measurements, the final requisite being to find without question of doubt the exact average dimensions of the adult male. Your mere hundreds of measurements, Belgarth, were pitifully inadequate. To find an unquestionable figure, we really should look over millions of skeletons. That can be done later, if necessary. Too," he said thoughtfully, "we should examine the skeletons of those beings with whom our being lived his life. Come to think of it, maybe we'll find the birthplace of the creature right now, ourselves."

Belgarth paused before he left the room. He looked back curiously. "You seem to attach an unusual amount of importance to the being's stature. Why?"

Orth spoke with a strange, quizzical expression, as if he were aware that the thought which he uttered was at variance with common sense. "If the being were slighter physically than the average males of his age, he may have desired greatly to be as large as they."

Belgarth stared. He burst into a short laugh. "You mean that the reason he killed himself was because he wanted to increase his dimensions to that of the average person? Even if it could be accomplished, that would certainly be the wrong way to go about it. And besides, why would anybody want to have different dimensions than the ones he has?"

"That might have been a prime motivating factor in the life of these beings."

"Aha!" Belgarth burst out triumphantly. "Now you're coming around to the 'ridiculous' theory I suggested!"

Orth was annoyed. "No such thing."

"No such thing," mimicked Belgarth angrily. "I guess you arrived at your theoretical conclusion by following an entirely independent line of thought. Well, governor, I think that conclusion is about as ridiculous a thought as any I ever heard in all my five thousand years of adulthood."

He left the room. By the time he came back, he and Orth had entirely forgotten the incident, for of such stuff were the Emonso made.

"What do we do now?" he demanded. "The philologists are taking scout ships out now, and the crew are on their way to the city. That leaves us inactive."

Orth was watching the rain outside through the view-plate. He gestured. "The rain is stopping. I suggest we take a walk around the ship for exercise."

There was only a slow patter coming down as they walked slowly. Orth was thinking. He said finally:

"It will be important if we find the birthplace of the creature. As I see it, being the only inhabitant of the planet, it is likely that the first time you ran across him he was 'at home.' At least, that conclusion is temporarily acceptable."

He stopped in midstep as a raucous sound burst through the air. Both creatures stared upward instinctively. What happened, happened so fast that neither was able to prevent it. A tattered, wet bundle of ebon feathers came streaking down out of the sky. It swept past Orth, fluttering momentarily in front of him, and then went streaking away.

Both Emonsos stared after it in astonishment as it alighted on the topmost branch of a eucalyptus. It was a winged creature with small bright eyes, and in its beak it held the jewel which Orth had been wearing on the stalk under his fourth eye.

Belgarth laughed. "A peculiar creature," he said. "I'll go get it back."

Orth took his attention away from the bird and made a disclaiming gesture. "Not now. We've got something more important to do. Get out one of the scout ships."

Scarcely half an hour later, the little scout ship came down into the atmosphere again, and Belgarth landed his ship atop a building whose roof was the exact spot of the take-off of the plane which had given him his first glimpse of the enigmatic creature who now reposed in a refrigeration museum on far Emonso.

This building was intact, though the city around it, in most part, was inconceivably demolished. Here and there rose other buildings which seemed to have escaped the holocaust through some miracle.

Brow knitted, Orth led the way to the roof entrance after studying the lonesome miles which stretched away into the quiet, encircling horizon. The dust of two centuries puffed upward under the tread of their multiple feet. They passed through dark, musty corridors which creaked and sagged threateningly. They entered room after room, descended level after level. Each room on the upper levels had been used, and used, apparently, for but one day. They identified beds for what they were. Covers and blankets were rumpled, rotten dust, and the centuries had gotten in their work. Windows were open or shut. The glass had fallen from all. Weather had crept inward and woodwork was rotting.

They identified stoves. Food receptacles stood about. Tin containers, which had been opened with a sharp instrument, were scattered about as if whoever had opened them did not care where they fell.

There was evidence that only one being had used these living quarters. There was evidence that he used them once, and then moved on to another room or suite of rooms; for on the third level from the bottom, they found suites which were untouched save by the years.

They moved through the city. They entered other fairly intact buildings, which had been used until there were no more ready-made beds available.

They walked through the streets, caught up in the brooding desolation of a vanished glory.

They came to a statue.

Belgarth stared upward at it, noting the progress the weather had made toward disfiguration. He was academically interested in the fact that the green patina of age was the only indication of ruination. Evidently, the statue was constructed of an extremely durable material. His glance roved over a face which had a noble breadth of forehead, a strong though sensitive mouth. In Belgarth's mind pulsed a faint dawning of recognition.

It was not until Orth had made an impatient motion and had gone on ahead of him that Belgarth realized exactly what it was he recognized. He experienced one of the few emotional shocks of his life.

Orth came moving back at his shout, his face puzzled.

Belgarth said, in a voice he forced to casualness, "There he is, governor—one and the same!"

He indicated the colossal statue, which reared upward a full hundred feet from the middle of a square in the heart of the city. Neither of them had ever seen anything like it before. Orth had simply accepted it as a peculiarity to be glanced at, to be wondered at, and to be forgotten. He perceived the powerful, symmetrical lines of the colossus, digested Belgarth's mite of information, and came to Belgarth's more strongly supported conclusion. It was the same man.

"And yet not the same," said Orth, his voice hushed unconsciously. "The figure you showed me, Belgarth, was scarcely that handsome. Nor was there that much nobility in the face."

Belgarth glanced sidewise at him, amused. "He has achieved dimensions greater than those of the average male—by about fifteen times!"

Orth was thunderstruck. "So he has!" he exclaimed. "Why . . . why, Belgarth, that was a shot in the dark, but damned if it isn't truth." His voice was drowned out in a deluge of his own thoughts, and the thoughts, to him, an Emonso, were uncommonly chaotic. His eight mouths opened and closed, and finally he burst out violently:

"Now . . . *now* the problem becomes worse! Why did he have his image set up here where his fellow beings could see it? Why did he increase his dimensions by proxy? And why did he give himself the soft, kindly expression which certainly was not his? I can see the purpose in erecting a life-size statue of a person after that person dies, but I can see no purpose in erecting a statue which is a lie. Do you think that we have inadvertently run across the very crux of the problem in this ridiculously malformed statue, Belgarth?" Orth was panting, angry, irritated, hopeless at the same time. He added vehemently, "Yes, I am convinced of it. If we knew for what reason he erected this statue while he was alive, we should entirely understand why he eventually destroyed himself."

"He was vain to the point of absurdity, remember," Belgarth offered. "The decorations on his chest proved that he desired to improve himself artificially. The statue may have been, in its way, another decoration. Although," he added, perplexed himself, "I fail to see in what way it improved him."

Orth said, in a burst of inspiration, "It may have been intended as a representation of him which, when looked at by the populace, psychologically impressed them as being the real thing."

Belgarth burst into a chiding, multiple laugh. "You're off the track. Such a characteristic might be an attribute of barbaric minds, but certainly not

of civilized ones. Look around you. This is a scientific, fairly highly developed civilization. You know the rule. Where there is a scientific culture there is also a semantic mentality."

Orth deflated. "That may apply solely to the Emonso," he said sulkily. He sighed, and grinned wryly. "All right, Belgarth. We'll stick to the rules. Well—let's go back."

The two creatures turned from the enigmatic colossus, and a certain curtain of glumness fell about them. The statue was voiceless. It would never speak, because it was inanimate. The inanimateness of the world about them, the lonely, destroyed world, would never allow them to know the true answer, because a dead world, too, cannot speak. For the first time, they had run up against an intangible barrier which their mentalities seemed incapable of penetrating, and it was depressing. Their scout ship lifted.

They went back to the ship. They listened to the telepathically inscribed reports of the philologists, learning the further depressing news that books and periodicals of current history were composed exclusively of an organic material. But the philologists assured Orth that, although such printed material was almost entirely destroyed through the vicissitudes of climate and organic decay, still they would be able to collect a plethora of material with which to work.

Governor Orth was not much impressed when they reported having accidentally found printed photographs of the being who lay on far Emonso. Such photographs, or drawings, in some cases, seemed to occur with some frequency in most of the current periodicals.

Orth said glumly, "Another 'decoration.'"

Belgarth smiled to himself. Although, as an Emonso, that wisest of all races in the known universe, he would have wished for a quick solution and would have done nothing to prevent it, still he felt a certain pride in having uncovered what would doubtless prove a real source of pleasure to his race that would last thousands or perhaps millions of years. As for his promotion, that was already a certainty.

At the end of a month, the crew, which had been at work uncovering skeletons, turned in an imposing list of figures. Belgarth ran the figures through his mind, which immediately returned to him an average figure.

He informed Orth, "The being was four inches shorter than the adult male of this climate."

"Send the crew to the place of the creature's birth," said Orth morosely. "Just a routine. I am already quite sure of his physical relationship to others of his kind."

The philologists had, in the meantime, reported themselves to be having a difficult time. They had found a language which had been in almost universal use. They were now breaking that language down into basic thoughts. So far, they had found whole paragraphs and pages which did not respond to the process. Such material resolved itself into incomprehensible gibberish, said the philologists. However, they would continue to try, at least.

After another two weeks, the chief of the group himself reported directly to Governor Orth.

"It's this way, governor." He groped for words. "Languages which are not rooted in our own tongue cannot be translated from the basis of word-meanings alone. Another root-connection must be found. Obviously, that connection can be found only in thought-patterns which are common to our minds and the minds of the others.

"So what do we do, governor? It's this way. We arbitrarily select a basic thought-pattern upon which we consider the thoughts of all intelligent creatures are built. For instance: The ultimate and even the direct purpose of all intelligent creatures is to solve puzzles. We use that as an absolute axiom, which proves its own truth. Then we proceed to work our way down from that, adding other less basic thought-patterns, and applying them to the language data at hand, until we have a mass of interlocked thoughts which correspond."

"I understand the process," said Orth impatiently.

"Of course. Well, say that that doesn't work."

Belgarth interposed. He said frowningly, "Has there ever been a situation in which it did not work?"

"You mean with that particular arbitrary axiom? Not that I know of." He added grimly, "I am almost certain that it always *should* work. It didn't in this case—positively."

Belgarth and Orth exchanged glances. Both were running over their sensations at the time of seeing the statue. Each knew that the other was experiencing sensations similar, and probably identical—a mental barrier, impenetrable, almost other-dimensional.

Orth said grimly, "Go on."

The philologist went on. "So that doesn't work. We then select another arbitrary axiom. Namely: All intelligent creatures seek intelligently that relaxation of mind and body which is known as recreation or happiness."

"And *that* didn't work," said Orth.

"No. Nothing translated itself further than two or three basic thoughts. What do we do then? Why, we play our trump card!"

"And that is?"

The philologist grinned triumphantly. He was evidently exhausted from his task, and various parts of his body were stained with chemical

reagents used in restoring the organic materials upon which the enigmatic language was printed. But he was proud of himself for knowing his business, even those parts of it which the Emonso had formulated millions of years ago, but had never found necessary to use.

"This one," he said softly, "has to work—you know? It's a kind of rewording of the second axiom: All intelligent creatures—we are defining intelligent creatures as those with semantic mentalities, remember—seek happiness by devoting themselves to the happiness of others entirely, forgetting themselves. Isn't that beautiful? Of course, as an axiom, it's a bit extreme to apply literally and exactly even to the Emonso, but it might conceivably apply to an utterly alien race. Well, we're going to work on it . . . but I thought you'd like to know that if this fails . . . but, of course, it can't . . . that if this fails . . . well—" He paused awkwardly.

Orth involuntarily raised his hand to the stalk under his fourth eye, but not finding the jewel which he commonly wore there, dropped it.

He said, his voice bitter, "All right, I get it. Report your progress as you go along— No, come to think of it, I'll take it in one dose. Let me know when you're—finished."

Three days later, the crew, working with excavated skeletons in the probable land of birth of the being who was the nucleus of the problem, came back with their figures, which Belgarth boiled down for Governor Orth's information.

"He was four inches shorter than his countrymen. His chest had an expansion of two inches less. His shoulders were one and a half inches narrower than his hips, an absurdly high ratio compared to that of the average adult male. His bones were far under the average in thickness and strength, and probably did not support strong muscles. Is that enough?" Belgarth was sarcastic. "It seems to me that you have arrived at a conclusion identical to mine, with far more expenditure of energy. Briefly, he would have had to go some to increase his dimensions to that of the average."

Orth sighed and said nothing.

Three days later, the chief of philologists called Orth by television from his place of operations. Orth, before he faced the man's image, got hold of Belgarth.

"Why doesn't he come with a personal report?" said Belgarth, puzzled.

Orth laughed shortly. "Ha! Why doesn't he! He's embarrassed, and he feels that he's in the wrong, and he's not got the moral stamina to tell me about his failure in the flesh. Failure. That's right. You see if I didn't call it right. Not that I blame him."

In the lounge, after one look at the tragic, shocked face of the philologist, Belgarth realized that Orth's prediction had been fatally precise.

"No success," said Orth coldly.

"None," the philologist said hollowly. He made a bitter gesture. "Oh, we had more success this time than with the other two tries. But—would you like to hear what our third arbitrary axiom gave us? For a while, we actually thought we were on the right track, and we were hammering away, and things were clicking into place, and we thought the problem was nearing solution. It was funny how neatly everything was turning out." He fell into a brooding silence. He said in a slow monotone:

"We thought we had found out who the being was. His full title would probably have been Captain of Games—you see? This planet was divided into sectors, with artificial boundaries. Each sector—and there were hundreds of them—was presided by a Captain of Games. Every once in a while, some captain would pick a sector to wage a game with. The whole population of the sector would be geared to turn out materials for the game, and millions of the population would participate in the game. It was not for their own enjoyment, but in order to give diversion and relaxation to other populations. Sometimes one sector would take on several other sectors. Distant sectors would enter into the spirit by joyfully turning out materials for both sides. Sometimes the whole world would be thus engaged, playing the game against the first sector, gaining a great deal of happiness from finally winning the game. In this case, the populace of the losing sector

would be made unhappy, but they wouldn't care, because they had sacrificed their own happiness for others.

"So much for the general picture. We discovered that our particular Captain of Games started the biggest game in all history. It was wonderful, governor, the way things were working out—until suddenly we struck a blank wall, and the words wouldn't translate."

"Wouldn't translate," said Orth hollowly.

"That meant that your third arbitrary axiom wasn't applicable, either," said Belgarth, just as hollowly.

"That's what it meant. It also meant that our translations up to that point were the sheerest hogwash. The being who concerns us was in a position of great importance. But he was not a Captain of Games—I doubt if there ever was such a title. No, the third arbitrary axiom must have led us so far astray that it verged on the ridiculous. So"—the philologist was plainly frightened at his own thoughts—"these people just think different. They think—thought, rather—so differently that I tell you right now, positively, with absolute certainty, that you'll never, *never*, even if you put the whole Emonso to work on it, ever solve your problem. That's my answer. It's final. I'm bringing my men back to the ship."

His face faded, and Orth and Belgarth sat there quietly, thinking their own thoughts.

The ship of the Emonso stayed on Sol Three for another two weeks. Orth, doggedly following a routine, had the entire crew busy loading the ship with exhibits of a dead civilization. The philologists were sent out again, with instructions to return with all the reading matter they could find, books and periodicals, in addition ot photographs. The crew brought back bricks, chairs, mirrors, the rusted motor of an airplane, anything and everything they could find which might later prove useful in an ultimate solution.

Orth had an unquenchable desire to visit the ruined city that lay to the north. He and Belgarth pursued a quick four-dimensional route which set them down in the middle of a crumbled street.

"Whatever he was," said Belgarth lowly, "I personally think that somehow he caused this. The same explosive tokens which fell around our ship two hundred years ago must at one time have fallen in this city, and other cities like it. But why?" He shook his head, and his voice echoed back to him.

Orth said, "The statue would tell the story—if it could speak. Mark my word, Belgarth, if the problem is ever solved, it will all go back to that. To the being's smallness relative to his fellowmen. He didn't want to be just as big as the average adult male. He wanted to be bigger. He wanted to be fifteen times bigger. That's why he built the statue."

They picked their way along slowly.

Orth added heavily, "You go on from there."

But Belgarth did not speak. What Orth had said seemed a logician's triumph. Being such, it was remarkable in that it did not explain anything. It did not explain any phase of the being's actions.

They took one last look at a quiet city, and went back to the ship, landing outside the air lock. No sooner had they touched solid ground, than the attention of both was attracted to a harsh cry emerging from a nearby tree.

Just visible on a topmost limb, a black bird with bright, shoe-button eyes was apparently cursing them with the full power of its lungs.

"Well!" said Orth, and he broke into a laugh. "Vociferous little devil, isn't he? Wonder if he's the one that took the jewel I was wearing."

"We could take a look and see," offered Belgarth. "Four-dimensional."

Orth nodded his agreement, and both creatures set their synapses into a certain pattern, and were forthwith looking at the world from an accustomed convolution of space. They identified the top of the tree as a series of transparent, concentric spheres hanging without support in the air. In another second they were solidly entrenched on top branches, leaves in their faces, an astonished bird, bested in its own element, fluttering upward with a frightened squawk.

In the crook of two branches, there was a nest. It was literally overflowing with pieces of colored, shining glass, with bits of colored string, with jagged, shiny metal fragments, with any liftable object which might have stood out against a drab background.

Orth took the jewel and placed it where it belonged. The bird recovered. It beat its wings in Belgarth's and Orth's faces until Belgarth, almost losing his hold, angrily brushed it away.

Belgarth frowned at the collection in the nest. He mused, "Peculiar. What do you suppose it wants with all that useless stuff?"

"Nothing peculiar about it," Orth shrugged. His thoughts were still wandering futilely through the blind alleys of what he considered a more pertinent mystery. "The brains of most creatures of this type are all thalamus—all emotion. This one apparently likes to collect pretty things, even if it can't find any possible use for them." He glanced down at the ship, and made a gesture. "Ship's ready, Belgarth. Let's go."

Belgarth agreed. The jackdaw cawed its threats at the moment the two wise creatures from Emonso disappeared into a four-dimensional matrix. Having scared its enemies away, it came back to peck jealously through the trivia in its nest.

THE END.

BOMBING IS A FINE ART

By Willy Ley

Aside from the fine art of finding the target, piloting the plane, and dodging ack-ack hardware in the sky—there's a fine art in the design of each of those cans of sudden or gradual destruction the bombardier sows.

It was in 1849 that the Austrians employed a new and no doubt secret weapon. The city of Venice, which had for long centuries termed itself the Queen of the Seas and, under Napoleon, had become a part of Italy and later a part of one of the numerous provinces of the Austrian monarchy, rebelled in 1848 and made attempts of secession. The Austrians tried to force Venice to remain a part of their empire and laid siege to the city.

When the siege dragged out and no decision could be obtained by customary military means, somebody in the Austrian army conceived a new weapon which, it was hoped, would subdue the rebellious city in short order. The new weapon was bombs, dropped from overhead. It was the first aërial bombardment in history. Of course there were no airplanes then, but the balloon had been invented about three quarters of a century earlier.

Experienced balloonists were scarce, however, thus the Austrians fashioned small balloons, just large enough to be able to carry a bomb weighing some fifty pounds. The bombs were equipped with a slow-burning fuse which, after some time, ignited a powder rocket, and then burned through the rope from which the bomb was dangling. The same rocket ignited a much shorter fuse which was supposed to explode the bomb when it reached the ground. A favorable wind was, of course, a prerequisite for the venture, but favorable winds occurred frequently enough. The Austrians made about three hundred of these balloons ready and used most of them. The results were discouraging; the population of Venice failed to be frightened into submission, although one of the bombs burst in the center of their beloved Piazza di San Marco. And, after sudden changes of wind had brought some of the flying bombs back to their own lines, the Austrians discontinued the use of their new weapon.

Nor did anybody else make any such attempt for many years to come. The French balloonists, who left besieged Paris in 1870-71 with mail and messages, did not attempt any bombing of the German lines, even though the Germans did them the honor of inventing for them the first anti-aircraft guns. Those guns were long-barreled pieces of about one-inch caliber; they were mounted on horse-drawn carriages and looked very progressive and mildly fantastic—but, as far as the records show, never hit anything.

In spite of various treaties that were signed between 1871 and 1914 air bombardment, as we understand the term, started during the first World War.

"Intelligence reports that the enemy is bringing up reinforcements along the Combarelles Road," a staff officer would say to his adjutant. And the adjutant would reply: "Shall I send a flying machine over for reconnaissance, sir?" And the staff officer would say: "Yes, but tell them to send three or four big ones, so that they can bomb them."

Whereupon several "big" airplanes, meaning two-seaters with a three-hundred-mile range and a cruising speed of seventy or even eighty m. p. h. would take to the air and fly toward Combarelles Road. Sighting the enemy troops the pilots would swoop low and the observers would reach down into the bellies of their planes, pull up pear-shaped bombs and heave them overboard from their open cockpits. The bombs weighed between fifteen and twenty-five pounds, had wire handles and a long strip of cloth to act as a fin. Their fuses were of the instantaneous variety, which means that they made the bombs explode the second, or rather instant, they struck the ground.

Near the end of the first World War such haphazard daylight bombing attacks on enemy troops or open enemy positions had given way to more or less systematic raids on targets far behind the front lines, often carried out at night and sometimes causing great damage and loss of life when directed against cities. Their effectiveness was not due to very careful planning or anything of that sort, but simply to the total lack of what is now called civilian defense on the other side.

Seen with modern eyes, even the biggest raids

of the first World War were simple and crude; they compare with modern planning of the "target for tonight" as the sword hacking of Roman gladiators compares to modern fencing.

This may sound as if bombing amounts to more than flying over an enemy position or city and jerking the lever of the bomb release. It may sound as if bombing were a fine art which requires skill and mastery of an intricate *technique*. If it does sound that way, it sounds the way I want it to. Because bombing *is* a fine art.

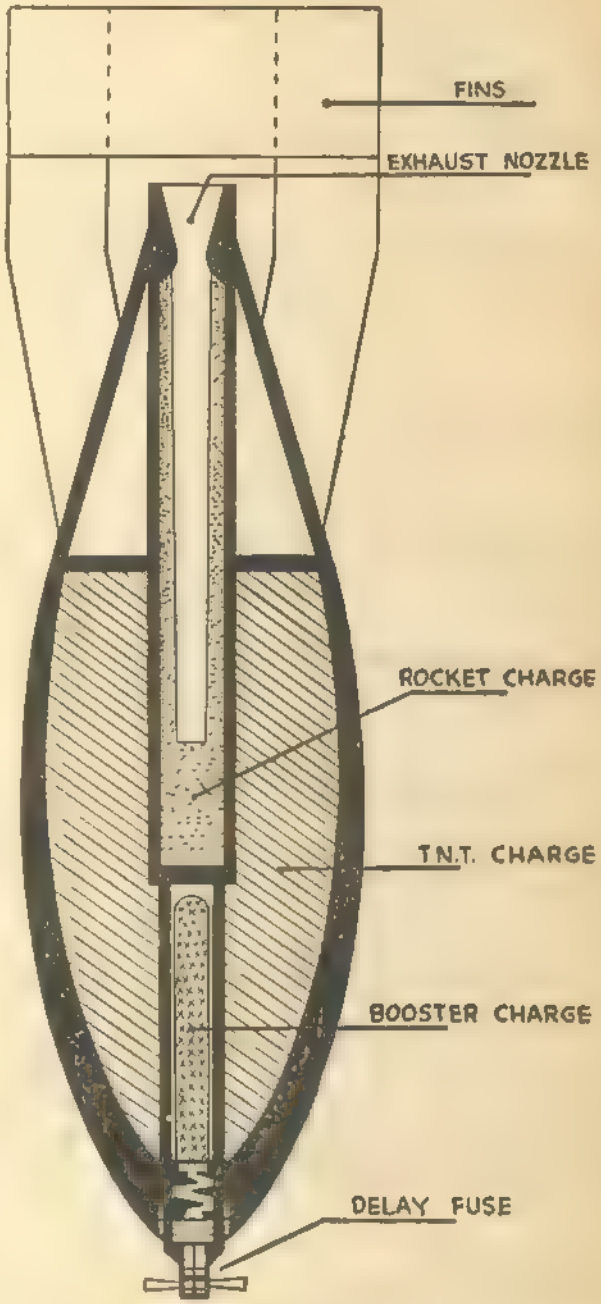
But, before going ahead with proof for this statement, it might be useful to get acquainted with the bombs themselves, especially since part of the proof is furnished by the wide range of bomb designs. Those early fifteen-pound missiles that were dropped by hand have undergone a great transformation during the twenty-seven or twenty-eight years since they were first manufactured. They have not only increased in size to enormous torpedo-shaped containers of TNT, weighing two thousand or even four thousand pounds, they have also branched out into three main categories with numerous specialized types. The three main categories are high-explosive bombs, incendiary bombs and poison-gas bombs.

While this is the order of their importance, I prefer to explain the various types in reverse order because those of the first group, the high-explosive bombs, are the most specialized.

Poison-gas bombs are very simple in construction. They consist of a thin-walled container for the poisonous substances, which is rarely a true gas but mostly a liquid. They have an instantaneous fuse which operates upon striking the ground or the target and contain only a small bursting charge. That charge is so small that it does no more than open the container; if it were more powerful, it would defeat the purpose of the bombs because it would scatter the "gas" around and thin it to such an extent that it would not be dangerous any more.

I am not certain whether poison-gas bombs existed near the end of the first World War. If they did, they were not used any more. Nor have they been used so far in the present conflict. The reason for this is, in my opinion, not so much the oft-quoted "fear of retaliation" but the fact that poison gas is unreliable and not very effective. Of all the varieties of poisonous substances tested for war use—and we can be fairly sure that chemists did not miss any bets—only two could be used in bombs: phosgene and mustard gas.

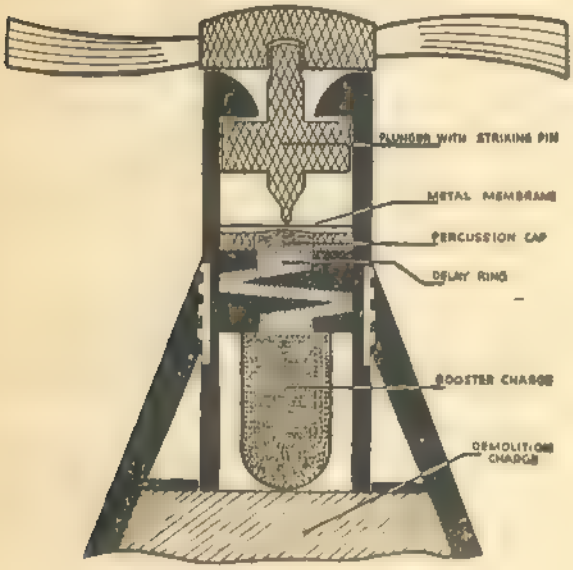
Phosgene ($COCl_2$ or carbo-oxychloride, known since 1811) is a very poisonous gas, deadly when inhaled in sufficient quantities—which are small—invisible in dry air and rather insidious. But it is easily destroyed by moisture and is stopped by any ordinary gas mask. Furthermore, it is not



"Penetration Bomb"

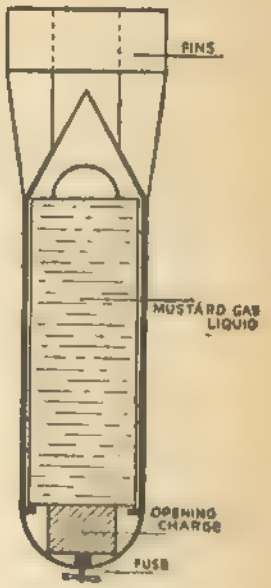
Design for a bomb to be used from dive bombers which will attain higher speed and penetrating power because of a rocket charge which assists in overcoming air resistance.

A description of the principle was published for the first time in the December, 1941, issue of the U. S. Naval Institute Proceedings. The Russians are said to use similar bombs to demolish German Panzer units.



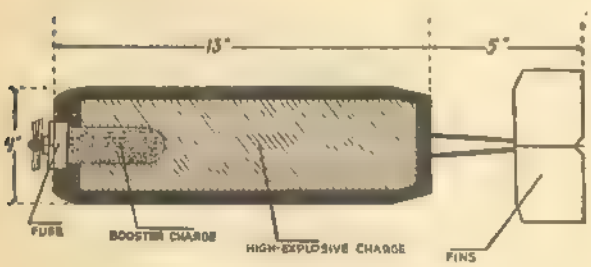
The principle of the tail fuse of a heavy demolition bomb. The fuse mechanism consists of a plunger bearing the striking pin, a percussion cap, a "delay ring" and a "booster charge." As long as the bomb rests in the bomb bay of the plane, the plunger is screwed to a small propeller. Falling through the air, the propeller turns and unscrews the plunger, which is then free, resting on a thin metal membrane. When the bomb hits the target, the plunger breaks the membrane and strikes the percussion cap. This ignites the delay charge, which burns for a second or two until it reaches the booster charge. The booster charge then explodes, setting off the demolition charge in turn.

Heavy demolition bomb, weighing about two thousand pounds and measuring some six feet in length with a diameter of about one foot. Such bombs have enormous destructive power but are not used against civilian structures, partly because of their price, partly because even a large bomber cannot carry many of them. All large bombs have both nose and tail fuses to reduce the number of "duds."

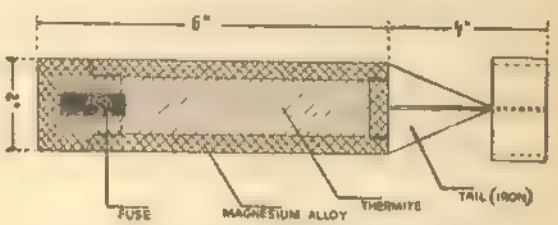


A poison gas—mustard gas—bomb of medium caliber. The bursting charge is small, just large enough to open the bomb. The mustard-gas liquid is probably confined in a special container which fits into the bomb.

Other chemical agents, such as the dispersed-powder harassing substances used as tear "gases," sternutators, or regurgitants could be similarly loaded.



Fragmentation bomb, American model, weighing about eighteen pounds. These bombs are straight-line descendants of the early airplane bombs used in 1915 in World War I. They are designed to explode the instant they touch the ground. Their thick walls produce many splinters which cause many casualties in the open, but which can be shielded off by two feet of sand.



Cross section of a German 2.2 pound — 1 kilogram — magnesium alloy bomb. The thermite core furnishes high temperature, the magnesium alloy furnishes the calories. Such a bomb burns for about twelve minutes unless sprayed with water.

persistent, which means that it has the tendency to disperse, so that it is difficult to obtain what is known as lethal concentration. In so-called cloud attacks in the front lines it was regular procedure to use one container for every yard of front line. Even so, only the first-line trenches of the enemy got full concentration. It would, therefore, require an enormous amount of bombs to gas a target from the air, weight for weight about five hundred times as much as it would need TNT to reduce the same target to rubble. And even then, the bombardment would not cost a single life if the men in the target—say an important factory—wore gas masks all through the raid and for some time after. Since phosgene is a gas, the weight ratio between bomb and its contents would be especially poor since it would require strong containers.

Mustard gas would do much better. It is a thick, oily liquid, about the color of honey when pure—which it rarely is—or dark bluish-black when impure. Its chemical name is Dichlorethylsulfide, the formula is $S(CH_2\ CH_2\ Cl)_2$. It is known since 1855 and called a vesicant or "blisterer" since it produces blisters on the skin which bear much similarity to a bad case of poison-ivy poisoning. Mustard-gas vapors can penetrate any kind of clothing, except very thick rubber or specially treated fabrics. They are, however, stopped by the gas mask so that a man exposed to mustard gas, but equipped with a mask, is poisoned only through the skin and not by inhaling the vapor.

This sounds rather ominous, but it is not as bad as it sounds. Mustard-gas vapor needs between twenty minutes and half an hour to penetrate a healthy skin; if it is removed during this period of grace, nothing will happen. Removing mustard-gas vapor can be accomplished by a shower of running hot water with plenty of soap. If the skin was hit by drops of the liquid, water alone will not remove it completely so the poison then has to be neutralized with an antidote. The most effective antidote against mustard gas happens to be cheap and plentiful, it is chloride of lime. The antidote reacts with the gas rapidly, thereby creating appreciable amounts of chemical heat; the chloride of lime must, therefore, not be used as a dry powder, but as a watery paste or solution as the water has only the purpose of absorbing the heat.

While mustard gas is most persistent—cases are known where persons entering old dugouts were poisoned slightly after years—it can be easily destroyed by being dusted with chloride of lime or a mixture of chloride of lime and sand. If no chloride of lime should be available for the moment, it is sufficient to cover the splash with a thick lawyer of sand so that the liquid cannot evaporate, then mark the spot and dispose of it later.

All this shows that a bombing with mustard-gas bombs does not tend to produce very remarkable results. It is true that some people would be bound to be poisoned, but, even with most primitive medical facilities available, they could all be cured a hundred percent. It was effective in the front lines, because soldiers in battle cannot go for a hot shower within half an hour after being exposed to the vapor. But the picture is entirely different in cities and even in small communities. Poison-gas bombs, therefore, would be of nuisance value only—and are not very likely to be used, except, perhaps, on the fighting front.

It is true that mustard gas, but not phosgene, could be sprayed from airplanes. In that case the plane could carry more gas, because the weight of the bombs would be eliminated. But in order to spray effectively, the pilot would have to descend to, say, thirty feet or less. If the victims are armed at all, this would be rather dangerous for the pilot, and if they are unarmed, the machine guns of the plane would be much more effective. No spraying would be possible over a city.

The category of poison-gas bombs looks likely to remain an item in manuals on bombing and in books on warfare. It is different, however, with the second category, that of incendiary bombs.

Of incendiary bombs there are two main types, the magnesium-alloy thermite type and the solid-oil type. The latter are the larger, weighing from twenty-five to one hundred pounds apiece. They are filled with oil which has been made solid by chemical treatment, usually saponification, and contain a small thermite charge which is ignited by the fuse. The heat developed by the thermite charge liquefies the oil and sets it afire. But solid-oil bombs have a most decided disadvantage. Oil needs large amounts of oxygen to burn, about three and a half times its own weight. The result is that the oxygen available in a closed room is used up in a very short time—actually not all of it is used up, because the oil fire stops when the oxygen content of the air drops below a certain percentage—and the bomb smothers itself.

Consequently, the term "incendiary bomb" is now almost synonymous with thermite bombs. And the most famous model of the thermite bombs is the German *Kilo-Elektron* bomb. *Kilo* is an abbreviation of kilogram—about 2.2 pounds—and *Elektron* is the German trade name for an alloy consisting of eighty-six percent magnesium, one percent copper and thirteen percent aluminum. While pure magnesium is prone to catch fire and to burn when handled wrongly, the *Elektron* alloy is perfectly safe. It does not ignite accidentally, not even when drilled, milled or machined. But it can be ignited and it is then even worse than pure magnesium. In bombs, the ignition is accomplished by a thermite charge which in turn is ignited by a fuse. Thermite is a mixture of

powdered aluminum and iron oxide. When heated it undergoes a chemical reaction which produces iron and aluminum oxide—it was originally developed by the chemist Dr. Goldschmidt as a means of reducing metal oxides. Since the reaction produces a temperature of about three thousand degrees centigrade—half of that prevailing at the surface of the Sun—the iron is, of course molten.

Such thermite bombs can ignite dry wood at a distance of ten feet or more just by radiant heat, but they are not unbeatable as the Nazi airmen were taught to believe. They were told that a stream of water, directed at such a bomb, would make the thermite explode and scatter burning lumps around, increasing the danger instead of decreasing it. This is almost but not quite completely true, a fire hose which delivers a large amount of water could be so used without danger. But it is entirely untrue for a spray of water. What happens is that the thermite charge is consumed first. This takes a little over a minute, two at most. Then only the thick *Elektron* container burns, also with a viciously hot flame, for a duration of from twelve to fifteen minutes.

Spraying the bomb with water shortens the burning time to about four minutes. The water feeds oxygen to the burning metal, thus increasing the rate of burning. But while the metal's combustion is accelerated, the water that misses the bomb douses its surroundings and extinguishes them if they should have caught fire before the spray was turned on.

The so-called Molotov bread basket is not really a new type of incendiary bomb, but more a new method of dropping it. The small incendiary bombs are not aimed anyway, they are scattered over the target area as widely as possible so that they may cause numerous fires not too close to each other. The purpose of the latter is to force the ground forces to fight each fire individually. The Molotov bread basket is merely a container for a number of thermite-type incendiary bombs. It has a somewhat angular bomb shape, with large vanes attached to its tail end. When the container falls through the air, the vanes cause it to rotate and after a certain speed of rotation has been attained, the sides drop open. Centrifugal force then scatters the individual bombs around.

The bread basket is not in use any more, probably because the huge container added just what the original designers of the thermite-magnesium alloy bomb had successfully eliminated: dead weight. But the combination of magnesium alloy and thermite is remarkable for another reason, too. The "combustible qualities"—I cannot think of another term—of the two substances nicely augment each other. Thermite is the substance that generates the hottest flame of all known combustible mixtures. But it generates only small amounts of heat, some eight hundred gram calories per gram. (For comparison: petroleum generates on the average eleven thousand gram calories.) Magnesium produces a flame less intensely hot, but it generates six thousand gram calories per gram. It can easily be seen that both substances together form a first-class incendiary.

The first category of bombs, those charged with high explosive, has more members than all others taken together. It may be remarked first that "high explosive" now almost invariably means TNT, or trinitrotoluene, if you want the full name. TNT is not the most powerful high explosive known, although it is near the top of the list, but it is by far the best for other reasons. It is utterly reliable in every respect. It does not form compounds with metals; it does not deteriorate when stored; it does not explode when burned or dropped or crushed. In short, it does not go off for any other reason than the one designed to make it go off: the detonation of a fuse in its immediate vicinity.

Theoretically a high-explosive bomb can do two different things. It can act through the force of the explosion, or it can wound and kill because of the splinters it produces. To do both at the same time is difficult—a bomb which is to cause damage by means of the splinters should explode the instant it strikes the ground, while a bomb which is to cause damage by the force of the explosion should explode a short time after striking the ground, so that it has time to penetrate as far as its kinetic energy will permit.

Whenever there are two theoretical possibilities, two different designs are the result. In this case the designs are fuse designs, one is called the instantaneous type, the other is named delayed-action fuse. A delayed-action fuse which is, we will assume, attached to the tail end of a large bomb, works in the following manner: A heavy metal plunger which bears a striking pin is inserted into a tube. The other end of the tube is blocked by the percussion cap, shielded by a metal membrane. When the bomb strikes the ground, the striking pin breaks the metal membrane and hits the percussion cap. The percussion cap then goes off, igniting a slow-burning powder composition which is embedded in a metal plug. Since the slow-burning composition is usually arranged in a circular shape, this part of the fuse mechanism is called the delay "ring." But the delay "ring" might just as well be a spiral, a helix or a straight line, that does not matter. What matters is the length of the slow-burning powder "string" because that determines the delay. When the flame has finally reached the other end of the delay ring, it ignites a special very sensitive charge which is known as booster charge. And the booster charge, in turn, sets off the main demolition charge. To

prevent the striking pin from forcing its way through the membrane because of an unexpected jolt, the plunger is equipped with a projecting rod the end of which is threaded. These threads fit into a cap which acts as a bolt nut. The cap carries two small propeller blades which jut out from the bomb. When the bomb falls through the air, the air resistance makes the blades turn and thus unscrews the safety cap.*

This is the principle of fuses for large bombs which are to bury themselves in the target before exploding. The fuses of small bombs designed to go off as soon as they strike the target are built the same way, except for the delay ring which is lacking.

Such instantaneous fuses are attached to small so-called fragmentation bombs, weighing from fifteen to twenty-five pounds—according to type and country of origin—and having very thick walls so as to cause many splinters. The larger bombs carry delayed-action fuses, usually two—one in the nose and one in the tail—in case one does not function properly. The weights of these larger bombs are, approximately, one hundred, two hundred fifty, three hundred thirty, five hundred fifty, six hundred sixty, eleven hundred and two thousand pounds. Four thousand pounders exist, but are used very rarely, mainly because they warrant expensive targets—say battleships at anchor—and require very large bombers to carry them. The reason for the queer-seeming weight of the bombs is that they are often designed in kilograms first and then expressed in pounds. The three hundred thirty pounder is really a one hundred fifty kilogram bomb, the six hundred sixty pounder a three hundred kilogram bomb, the eleven hundred pounder a five hundred kilogram bomb and the four thousand pounder an eighteen hundred kilogram bomb.

When the Nazi *Luftwaffe* bombed English cities daily, they employed, for a short time, a very specialized heavy bomb which became known as "land mine." Knowing that the blast of a very big explosion would demolish flimsy old-fashioned brick buildings at considerable distance, they took small thin-walled naval mines, filled them with a tremendous charge of high explosive and dropped them from airplanes. The land mines weighed two thousand and three thousand pounds, some experts claim that even four thousand and six thousand pounders were tried. The land mines had very sensitive instantaneous fuses and, to make sure that their weight would not bury them in the ground even partially, were equipped with parachutes which reduced their falling speed. It was clearly an adaptation of the laying of naval mines from airplanes. The explosions produced by these land mines were tremendous—a two-thousand-pound land mine carries about sixteen hundred pounds of high explosive, while a two-thousand-pound demolition bomb carries at best one thousand pounds—but apparently they did not fulfill the expectations harbored by the Nazis because the use of land mines was discontinued.

The multitude of bomb designs proves already that bombing is now a highly developed art, with specialized types of bombs available according to the nature of the target. If results are to be achieved, careful preparations are required.

The crudest type of bombing now in existence is the all-out mass assault against cities with demolition bombs and incendiaries. But so far it has always failed—Barcelona and London are still the prime examples—possibly because of its crudeness. The idea was, of course, to terrorize the population and to frighten it into revolt and surrender. Instead, it always increased the will to resist.

It seems that even in total war a bomb dropped on a military position or establishment of the enemy is worth more than a bomb dropped just on any building in enemy territory. Unless the morale of the citizen is demolished along with the dwelling place he used to live in, it is sheer waste of expensive bombs to ruin apartment buildings.

The problem of avoiding the waste of bombs has two answers. One of them is precision bombing of targets useful to the armed forces of the enemy, the other is careful selection of such targets.

As for the latter, the British have developed a special system. It works about like this: an army expert finds it desirable to have a certain target bombed. First he finds out about the target whatever he can, then he puts down all the information he has, and all the reasons for bombing this target he can think of and writes something like a lawyer's brief. It is a plea for bombing this or that target, supported by a wide range of reasons and augmented by as much information as possible. This plea is called an "Appreciation."

The Appreciation not only states that there is a factory at this or that location, which seems to be used as an assembly and repair shop for German tanks and artillery pieces, but it also states: that the factory was built in this or that year; that it is a solid structure which would not be damaged much by one-hundred or two-hundred-and-fifty-pound bombs; that probably eleven-hundred-pound bombs would be needed to do the job well; that the location is free of small buildings that could be set afire by incendiary bombs; that the building has been erected on sandy ground; that the power lines leading to it come from such and such a power plant. It contains, if possible, construction plans—they may once have been pub-

* In time bombs the plunger is backed by a tensed spring which is arrested by a wire. When the bomb strikes, a glass tube containing acid breaks and the acid begins to eat through the wire. After some time, six hours, a day, or more, the wire gives and the spring shoves the plunger into the percussion cap. Of course there is no additional delay ring

lished in a trade journal or an architectural magazine—and photographs of the structure, actual photographs or clippings from old magazines and newspapers, whatever is available and will serve the purpose. Finally, the Appreciation outlines various routes of approach, with information about suspected antiaircraft batteries along these routes.

The Appreciation, worked out by *G2* or Intelligence Section, usually emerges as a fat folder which requires some study to be digested. It is then forwarded to the Bomber Command. Assuming that the Bomber Command has no reason of its own to forgo the opportunity of bombing an inviting target, the passages from the Appreciation which will be useful to the fliers who do the actual bombing, are condensed and mimeographed. Finally, the objective recommended in the Appreciation is ordered as "target for tonight," usually with an alternate target, in case the bombers should be unable to reach the original target for unforeseeable reasons.

How useful such groundwork can be has been proven by the closing of the Corinth Canal. Originally, aërial minelaying was under consideration, but then a geologist turned up, saying that the builders of the Corinth Canal had had trouble with cave-ins which were especially likely at a certain point. Fortunately, that point had once been photographed for the newspapers and an old clipping was dug up which showed this picture. The Bomber Command then knew what to do and one single heavy bomb opened a fissure and dropped the cliff into the water, thus blocking the canal for a long time.

Knowing what is worth-while to bomb and what bombs to use is only part of the whole story, however. The bombs also have to get there.

This is the point where bomb releases and bombsights become important. The bombs are no longer suspended underneath the wings, as was once customary; they would offer too much air resistance and reduce the speed of the bomber. They are now suspended from bomb racks in the bomb bay of the plane. The bomb bay occupies the lower part of the central section of the fuselage. It is closed by a trapdoor which is not opened until the bombardier is ready to jerk the release lever which will release the bombs either singly or in pairs, or, if desired, the whole load at once.

As soon as a bomb is released it starts out on a journey of its own, governed by a whole collection of different factors which mainly try to counteract each other. The result is that the actual bomb trajectory only *resembles* other things on earth or on paper, with the subsequent result that it gives nightmares not only to people who expect to be bombed but also to those who try to calculate the exact trajectory.

The most important factor in the melee is, of course, gravity which tends to pull the bomb straight down. But the horizontal speed of the bomb, which is the speed of the airplane at the moment of release, prevents that. This speed carries the bomb forward while it is already falling, the distance from the spot over which the bomb was released and the spot where it hits is called the "range." The trajectory of the bomb, resulting from the struggle between forward speed and gravity, looks very similar to a parabola. Actually, it is closer to being a part of an ellipse, with the center of the earth in one of its focal points. It would be that, precisely, if air resistance did not enter the picture.

Air resistance does two things: it shortens the path of the bomb by braking the forward speed, and it slows the falling speed of the bomb by resisting movement in general.

A few figures may help to make this a little clearer:

We will assume that the bomber travels at an altitude of twelve thousand feet with two hundred forty m. p. h. when the bomb is released. In a vacuum the bomb would need close to twenty-seven point five seconds to strike the ground; because of air resistance, it needs about thirty seconds. Moreover, the vacuum path would carry the bomb some two hundred feet farther than the actual trajectory in air. The range, in this example, is actually nine thousand seven hundred eighty feet—from an altitude of six thousand feet it would be about seven thousand eight hundred feet—in other words, the bomb strikes close to ten thousand feet ahead of the point of release. But during the thirty seconds the bomb needs to travel along its curved trajectory, the airplane has traveled two miles and the bomb strikes the ground about a quarter of a mile behind the plane.

If there is a strong wind, another factor is added. If at all possible, the pilot will simplify this factor by making his "run"—which means flying in a straight line at a constant speed for the interval during which the bombardier is busy working out the range—either with or against the wind. Things do go wrong just the same occasionally because the wind may blow from different directions at different levels. The mechanical—and hurried—computation of all these factors is the job of the bombsight, and the complexity of the problem will explain why bombsights are such closely guarded military secrets.

Naturally it is easier to hit a target from a lower altitude, but that cannot be done unless there are no antiaircraft batteries around. They spoil the bombardier's aim by keeping the plane high and, if the ground defenses are sufficiently massed, they may spoil it even more by making the "run" impossible or at least dangerous.

Bombing from a very high altitude, provided the bombsight is trustworthy and the visibility good, has an advantage, though. It makes the bombs arrive with a higher speed, thus giving them higher power of penetration. Bombs are at a very decided disadvantage when compared to artillery shells of the same weight. The force of impact of a projectile depends on two factors, its mass—weight—and its velocity. The latter happens to be more important since the formula for this is simply the formula for the kinetic energy which reads:

$$K.\,E. = \frac{m}{2} v^2$$

It works as follows: Assuming that we have a shell or bomb weighing one hundred pounds and striking the target with a velocity of one thousand feet per second, this shell then has a certain kinetic energy. If we make the shell strike the target with the same velocity but make it weigh two hundred pounds, its kinetic energy is twice as large as that of the one-hundred-pound shell. But if we take the one-hundred-pound shell and, without any other changes, make it strike with two thousand feet per second, the kinetic energy is four times as large as that of the slower one-hundred-pound shell.

The peculiar disadvantage of bombs is that they have no initial velocity. Their speed—disregarding the speed of the airplane which appears only as forward movement—is simply the result of gravitational attraction, minus air resistance. But air resistance also grows in leaps and bounds as soon as things fall really fast. The result is that the speed of a bomb is limited, after some time the air resistance grows to such proportions that all the tugging of gravity has no further effect. This limit is called the "terminal velocity" and no bomb can go beyond that. It is not the same for every weight and shape, but the differences are small, the terminal velocities of high-explosive bombs range from eight hundred to nine hundred fifty feet per second.

The terminal velocity of a five-hundred-fifty-pound bomb of normal shape is nine hundred eighteen feet per second. When dropped from an altitude of twenty thousand feet, the bomb actually strikes the ground with a velocity of eight hundred eighty feet per second. This is good enough as far as the comparison with the possible ultimate of nine hundred eighteen feet per second goes, but it is only one third of the impact velocity of a shell of the same weight. Which means that that shell has about nine times the kinetic energy.

And all these facts, taken together, explain why the bombing plane did not make artillery obsolete as was once believed, why the British rely on the guns of their battleships if they want to do some really thorough smashing, why the Flying Fortresses—Boeing B-17—which can outclimb almost anything in the air can bomb so effectively and why the trend is to heavier and heavier bombs. It is the only way to increase the kinetic energy, adding mass, since it is not possible to add speed. Some experts have estimated that a one-thousand-pound bomb will do eight times as much damage as four two-hundred-fifty-pound bombs—not only because of greater kinetic energy but also, and mainly because of what may be called the concentration of destruction. This estimate seems a little high to me, but it is essentially true.

Naturally the question about future trends in bombing comes up now. What new types of bombs may be developed during the present war? New incendiaries? Unlikely, the combination of magnesium alloys with thermite is good enough. New poison-gas bombs? Very unlikely, there seems to be no possibility of "new" gases left and any kind of gas would have too many disadvantages. Bacterial bombs? Still more unlikely. It needs more than swallowing or inhaling a few bacteria to become infected since, if bacteria are dropped into reservoirs, the ordinary processes of water chlorination and oxygenation will take care of them.

New high-explosive bombs?

Yes, and it is even possible to outline the trends. In the first place, the trend is toward bigger and heavier bombs. In the second place, TNT *might* be abandoned in favor of a more powerful high explosive. More powerful high explosives than TNT exist, the reasons why they have failed to dislodge TNT from its position as *the* high explosive are of various kinds. One of them might be, in some cases, that the more powerful high explosive is not barrel safe, i. e., that it would not stand the shock of being fired from a gun. This, of course, does not apply to bombs, and, if there is a high explosive more powerful than TNT against which there is no other objection than that it is not completely barrel safe, this high explosive may be used in bombs.

But there is one other development indicated: the penetration bomb. Last year I prophesied it in an article published in the *U. S. Naval Institute Proceedings*, and very recently it has been reported from Russia that the Red Air Force is using bombs that are the same type or very similar.

To explain the penetration bomb, dive bombing has to be explained first. As is well known, dive bombing consists in diving the plane in a straight line toward the target, releasing the bomb at a low altitude—around two thousand feet—and then "pulling out" of the dive, while the bomb continues the straight-line path. The advantage of dive bombing is that it is more accurate than high-altitude level flight bombing, the disadvantage is that the bomb strikes with a rather low-impact velocity, even though the diving speed of the plane has to

be added to the speed it acquires falling. The impact velocity of a bomb released at two thousand feet from a two hundred m. p. h. dive is only four hundred forty-five feet per second. If the pilot dares to go lower before releasing the bomb, it is less.

There exists the possibility, however, to accelerate a bomb dropped from a dive bomber by means of a rocket charge. It does not require a complicated mechanism, just a powder charge compressed in a steel tube which is fitted into the bomb.

Such a rocket, carrying a charge of twelve pounds and weighing about thirty-five pounds in all, would work minor miracles in a dive bomb if it delivers a thrust of some eleven hundred pounds for two seconds. Even more powerful thrusts have been attained with experimental powder rockets, the assumptions are, therefore, well within the limits of probability. By means of such a rocket charge, pushing the bomb down against air resistance, the kinetic energy of a two-hundred-ten-pound bomb, released at one thousand feet with two hundred m. p. h. would be *tripled*. The kinetic energy of the same bomb, released from three thousand feet, would still be doubled, while for a release altitude of two thousand feet we get the intermediate value of two point thirty-four times the kinetic energy of the rocketless bomb.

For a five-hundred-fifty-pound bomb the altitude of release—assuming the same small rocket charge—would not make so much of a difference, in each case the kinetic energy would be roughly one and a half times that of a five-hundred-fifty-pound bomb without rocket charge. But there is no reason why more powerful charges, or several charges of the eleven-hundred-pound thrust variety, should not be used in larger bombs.

The velocity of impact of such penetration bombs, as I labeled them, would still be much less than that of a shell of the same weight, but it would approach the impact velocity attained in level flight bombing. General introduction of such bombs, therefore, would improve the effectiveness of dive-bombing: firstly, by making it still more accurate—the accelerated bomb follows a much straighter path—and secondly, by adding the punch of higher speed to the bomb's weight.

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THE END.

AST—6H

THE LINK

By Cleve Cartmill

● Even the first and lowest of true men may have had a certain indefinable something about him that made the animals of the world hate—and fear—him!

Illustrated by Kolliker

Lok knew that he was different from his brothers after the incident with the big black and yellow cat.

It stood in the trail and looked at him. True, it drew back its lips exposing long, yellow tusks, but it did not growl insults, it did not attack.

After a time, the cat said, "I could eat you."

Lok returned the steady, yellow gaze.

The cat asked, "Why don't you run into the trees like the others? What are you doing here?"

"I am seeing pictures," Lok replied.

The cat arched its back and snarled with suspicion. "What is that?"

"Why . . . why," Lok faltered, "things."

The cat edged back a pace.

"Things," Lok continued. "My brothers have tried to kill me. I am alone. I am going . . . going—" He broke off, puzzled, and stared with vacant, dark eyes at the cat.

"You have no hair," the cat said, moving forward again.

"I have, I have!" Lok cried desperately, and shook long, black locks over his face. "Look!"

"That!" the cat sneered. "It is not like the others."

The others. Lok sensed a power within himself when he thought of the others, a power that did not quite come into focus. It swelled up into his chest, however, and he straightened so that his knuckles were not on the ground.

"I am Lok," he said with dignity. "Therefore, step aside. I would pass."

He marched deliberately toward the cat. It crouched back on its haunches, spitting between fangs, but it gave way. Its eyes were wide and yellow, no longer instruments of sight now that it was suddenly afraid. Roaring incoherent blasphemies, it backed down the narrow path as Lok advanced. With one last cry of rage, it leaped into the wall of vines to one side, and Lok passed on, his low and leathery brow creased in thought.

He forgot the cat on the instant, but this new power held him erect as he moved away from the country of his tribe.

His inner perception strove to grasp what had happened to him, and, as he marched along the trail, he sifted the symphony of the jungle with subconscious attention. He noted the quiet, wrought by the roars of the curve-toothed jungle king. He felt the sleepy rhythm of the hot afternoon begin to flow again; somewhere a red and green bird shouted harsh and senseless cries; succulent beetles buzzed stupidly in trees; off to the right a troupe of his little brown cousins swung by fingers and tails and chattered of drinking nuts; moving toward him on the trail swelled grunts of the white tusks.

This latter sound snapped him back to a realization of danger. He wanted no quarrel with a tribe of these quick, dark prima donnas, with their tiny, sharp hoofs and short, slashing tusks. Even the jungle king himself would tackle no more than one at a time. Lok broke through the green trail wall and went hand over hand up a thick vine, to wait for the white tusks to pass.

They trotted into sight, twenty yards away, four full-grown males and three females. The leader, an old boar, with tiny, red eyes, grunted tactical instructions in case of attack at the next trail curve.

Lok felt an ancient fury, and from the safety of a high limb he jumped up and down and screamed imprecations at the bristled band.

"Cowards!" he yelled, flinging handfuls of twigs and leaves at them. "Weaklings! Fish food! If you come up here, I will fight you all!"

At his first cry, the males had wheeled and stood shoulder to shoulder facing his tree, looking up at him with steady, gleaming eyes. The females huddled behind this ivory-pointed rampart, waiting without sound or motion.

The old leader grunted his contempt for Lok and his race.

"Come down," he invited. "Fool!"

Lok ceased his age-old antics, and regarded his actions with a dull sense of wonder. True, he had always done this; it was a part of life to insult

other inhabitants of his world from a place of safety. He had done this with his brothers, and with his mother while he was still small enough to sit in her hand.

Yet this new part of himself which controlled his new sense of power sneered at such conduct. Lok felt at first like hanging his head; then he felt the need to assert himself.

He climbed down the vine, without fear. He marched toward the white tusks who now held their armored muzzles low to the ground in attack position.

"Wait!" the leader grunted to his companions. "This one has a strange smell."

Advancing steadily, Lok said, "Step aside, I would pass. I am Lok. I am master."

When he was within three paces, the white tusks acted.

"Go!" grunted the leader to the huddled females. "Remember his smell!"

The leader and the three younger boars backed away as Lok advanced. When they had retreated twenty paces in this fashion, they broke and wheeled at a signal from the old one, and pattered after the vanished females.

Lok stood motionless for some time, gazing vacantly but steadily at the bend of trail around which the white tusks had fled. Beside the last image of their curling tails and bobbing hindquarters now formed the picture of the furious, but frightened, cat.

For the first time in his twelve years of life, Lok used past experience to form a theory. It was vague and confused, but he felt that he could reenter the tribe and rule in place of the Old One. He was Lok. He was master.

He departed from the trail and climbed to a remembered treetop pathway which would lead him to his tribe. As he leaped and swung from swaying limb to limb a troublesome feeling grew within his head. He felt that a matter of importance

should be considered, but its form and shape escaped his powers of concentration.

His passage did not disturb the life of the sultry green forest. Gaudy birds flitted through the gloom, and hunting beasts made fleeting shadows at times below him. The sun dropped, stars flared overhead, and Lok found a sleeping crotch for the night.

Sleep evaded him. Not because of night cries of questing white owls, or of brief threshings in the nearby pool of a gurgling stream, or of directionless roars of the big cats. He was accustomed to this pattern of sound.

The disturbance was deep within himself a troubling problem knocking at the door of memory. It was a new sensation, this groping backward. Heretofore he had been satisfied if there was fruit, if rotten logs yielded fat, white grubs. He had been content when fed and sheltered.

Consideration of shelter brought the problem nearer to recognition and, as he concentrated, it burst into form. The problem was one of the passage of seasons. Since he had left the tribe, followed by foaming threats of his brothers and the Old One, the rains had come twice. His lack of a protective furry coat had driven him into caves where he had shivered through the long, damp months.

Well did he know now what had made him uneasy. The tribe might not know him, after this long space of separation. An event took place, and during the time it affected them they considered it. Once it was over, it was as though it had never existed. Thus it had been for him, too, until now.

Lok's head began to ache, but he clung stubbornly to the pictures that formed in his thoughts. He saw himself forced to subdue the strongest of the tribe before he could take his rightful place at their head.

He was Lok. He was master. But he was not as strong as some, and in a fight where strength alone would determine the outcome he might be subdued and killed.

Restless, wide-awake, he shook his head angrily and climbed to the highest level in search of a place where he might sleep. He moved from one tree to another, grumbling to himself. He crossed the stream near the drinking pool which gleamed in full brilliance under the shining eye of night.

He was instantly thirsty, and dropped lower. As he did so, his watchful eyes caught movement at one edge of the pool, and the arm of a ripple moved lazily across the bright surface. A long snout lurked there. Though he was large and unafraid, Lok wished to avoid a brush with those long, fanged jaws or the flashing armored tail. He half turned to go upstream to a place of safety, but was arrested by a sound on the trail. He caught the delicate scent of a spotted jumper, and presently saw a trio, mother and two small twins, advancing to the pool in dainty leaps. The mother's long, leaf-shaped ears were rigid, twitching toward every rustle in the night. She held her shapely head high, testing the air with suspicious nostrils, and the end of every pace found her poised for instant flight. The little ones, crowding her heels, duplicated her every motion.

Lok eyed the tableau with excitement, knowing what was coming. He could see the faint outline of the long snout motionless in the shallows near the path. A meal was in preparation.

The mother led her twins to the edge of the pool and stood watch while they dipped trusting muzzles in the water.

Lok saw blurred motion as the long snout's tail whipped one of the little twins into the pool and powerful jaws dragged it under. With a cry of terror the mother and the remaining twin flashed into the darkness, the sound of their racing hoofs smothered by the threshing in the pool.

The turbulent surface darkened, and Lok cried out once from suppressed emotion. Presently he returned to his sleeping crotch, his thirst forgotten in consideration of what he had seen.

The long snout, Lok knew, was no match for spotted jumpers on land. Although the long snout could move for a short distance with great speed, the spotted jumper could simply vanish while one looked at it. Yet the long snout had caught, killed, and eaten one of the small spotted jumpers.

Another factor, in addition to simple speed or strength, had made this possible, and Lok beat against his head with a closed hand trying to call it to mind. The long snout had waited like one of the big cats above a trail—

Lok felt the solution begin to form and fixed wide, empty eyes on the dark while he made pictures inside his head.

He had seen a cat crouched on a limb in an all-day vigil, waiting without motion until its chosen prey trotted along the trail below. Then a flashing arc, a slashing blow, and the cat had slain an inhabitant sometimes more than twice its own size and speed.

He had seen also a fear striker, many times as long as Lok was tall, coiled in hunger beside a trail for a whole day or night until the proper sized victim passed. Then a flashing strike, whipping coils, a crushing of bones, and the fear striker held the limp body of one he could not possibly have caught by speed alone.

Yet the lying-in-wait alone was not the answer to the problem of his conquering the tribe, Lok felt. It was not his way to crouch near a rotten log until the Old One, for example, came to tear it apart for grubs and then fling himself on the hungry one. No, not that, but still the essence of what he sought was there.

Each denizen of the world in his own fashion delivered a death blow to his prey. With the long snout's tail—

Lok cried out in the night as he found the answer. "I am master!" he shouted. "I am Lok!"

Ignoring the sleepy protest of a bird in the neighboring tree, he slipped to the ground and coursed through the brush seeking his weapon, a short, stout limb.

When he found it, he stood in the darkness swinging it in vicious arcs, filled with an inner excitement. Pictures formed again in his mind.

When two males of his tribe fought, they shouted preliminary insults until rage was at a sufficient pitch for loose-armed, bare-fanged combat. How devastating, Lok thought, to step in during the insult stage and surprise his opponent with a death blow.

As soon as vivid dawn brought raucous, screaming wakefulness to the jungle, Lok continued toward the land of his tribe. He found sustained travel in the trees impossible while hampered with his weapon, and dropped to the jungle floor, slashing vines aside with the club when the going was thick.

Once he climbed a tree for long fruit to satisfy his hunger, and once he drank from a stream, searching somewhat eagerly for a long snout on whom he might try his new weapon.

He came at midday to the edge of a wide, treeless plain covered with waist-high yellow grass. Lok hesitated to cross it on foot, for out there, lurking near the herds of the striped feeders, one sometimes saw big heads.

These were yellow, catlike killers, more powerful than the jungle cats, more feared than any. They were not only powerful, they were agile and ruthless when in bad temper.

Yet if he did not cross the plain he would be forced into the trees for a long circuit, and must abandon his weapon.

That decided him. He was fond of this heavy, knobbed length of wood. It seemed to give him an additional arm, and it doubled his courage. He set out through the yellow grass, circling a grazing tribe of striped feeders in the hope that he might pass unchallenged.

Presently he struck a path wriggling in his general direction, and it was on this path, in the center of the plain where there was no shelter, that he met a huge, golden-eyed big head.

It came upon him face to face, trotting as noiselessly as Lok, a heavy-maned, full-grown male. The two froze in their tracks, and the big head gave a roar of surprise. Lok drew back his weapon, holding it near one end with both hands.

"I will kill you," Lok said, a slight quaver in his voice, "if you do not go away."

"What?" the big head roared in disbelief.

Lok repeated his threat in a more steady voice.

The big head crouched, swishing his tufted tail.

"You have a strange smell," he said.

Lok detected a note of uneasiness, and his courage rose to reckless heights.

"You are a coward!" he cried, and jumped up and down on the sun-baked trail. "Weakling! Fish food!"

The big head hesitated a second. Then with a roar of unintelligible rage he launched himself at Lok, jaws wide and red, claws unsheathed.

Lok darted to one side and swung his club. All his strength was in the blow which caught the big head in his yellow ribs while in midair. The tawny beast twisted, was deflected out of the path and fell heavily in the dry grass. He was on his feet instantly and in the air again, coming at Lok almost faster than his eye could follow.

Lok felt a hopeless surprise when his blow did not kill the big head, and confidence in his weapon deflated. But he swung again, and the club thudded home on the big head's neck. The powerful body jerked again in the air and sprawled away from the path.

The big head was not so quick in resuming attack. He crouched in the grass which his fall had flattened, and roared gibberish at Lok, who held his club at ready.

A little of Lok's confidence returned as he looked steadily into the blazing eyes which had taken on a tinge of reddish green. Yet he was afraid, for he well knew the power of those fanged, dripping jaws, and the death in each front paw.

Entirely aside from his thoughts of self-preservation, Lok was exhilarated by the scene: the sleek tan body rippling with taut muscles, the wide grassy theater of action, and the excited yaps of an approaching troupe of dead eaters gathering at a distance to dispose of the loser.

Flecks of dark sweat spotted the smooth body of the big head, and Lok felt his own body growing moist and then cool as a light breeze brushed past.

Without warning, the big head leaped a third time. Lok, caught slightly unaware, swung his club without definite aim and without the full power which he had put into his previous blows. He caught the cat just below one ear.

As the blow struck, Lok had the impression of a drinking nut being broken by striking it against a stone. It was a satisfying sensation as it ran up the club into his arms, but he attached no importance to it until he saw its result.

For the big head twisted again in the air and tumbled into the grass, dead with a crushed skull, lips skinned back from long, yellow fangs. Lok stood well away from the still body for a few moments, eying it with a dull sense of wonder.

His other blows had been mightier than this

which terminated the battle, yet they had wrought no apparent damage. After a short time, he prodded the motionless body from a distance with his club.

"Coward!" he snarled softly. "Arise!"

When further abuse brought no reaction, Lok shouldered his club and went on his way, and the slinking dead eaters swarmed upon the corpse behind him.

He examined the plain in all directions for evidence of other big heads but saw nothing except the upraised heads and pointed ears of a herd of striped feeders who had heard the roars of battle. Lok continued cautiously toward the far jungle wall, thinking of the strange effect of a light blow on the head as compared to a heavy blow on the body of the big head. He felt no sense of accomplishment, although he was perhaps the first of his tribe to vanquish their most feared enemy. He was puzzled.

He soon dismissed the matter, however, for the more pressing problem of locating the tribe. When he reached his home country, a land of fruit and grubs near the foothills of a tall mountain range, he roamed in a wide circle. As he searched, an uneasiness grew within him, a sense of need for action.

Something was wrong, something completely dissociated from his finding the tribe. Other denizens of the forest felt it, too: birds reflected it in sharp, nervous cries, and the jungle reverberated now and then with baffled roars of big cats.

On the second night, while Lok was drowsing in the crotch of a thick, white tree, a distant growing murmur brought him awake. The murmur grew in volume to a sullen rushing roar as a wall of wind moved through the night.

On all sides was the crash of falling trees: first an ear-splitting *crack* as wind-strain shattered the trunk, a groaning *sw-i-i-sh* and finally an earth-shaking *boom!*

Lok shivered with discomfort in the sleeping crotch. He understood his uneasiness of the past two days—the rainy season was about to begin. Although he was fairly safe in this stout tree, he longed for the dry protection of the cave he now remembered.

A far-off mutter of rain deepened as it rushed across the treetops with the sound of a great herd of stampeded striped feeders. Lok felt a certain terror, which increased as brilliant twisting tongues lashed out of a roaring sky.

He shrank closed to the tree which now leaned at a steady angle from the push of the wind, and grew wetter and more uncomfortable as the night wore on. During the lull when the quiet center of the storm moved past he shivered in dread of the wind which would now blow, even more fiercely, perhaps in the opposite direction.

When a leaden but dry dawn broke, Lok resumed his search for the tribe, torn between the desire for leadership and the desire for shelter.

Fallen trees were everywhere and though the rotten cores of many housed fat grubs, Lok took to the forest roof where his passage was unhindered by wet, tangled vines or a myriad of tiny, poisonous many legs and whip tails that scurried about.

The sun came out later in the morning, and Lok found the tribe near midday in a steaming clearing.

Perhaps fifty in number, from huge gray-tufted males to babies clinging to their mothers, they eyed Lok with sullen suspicion as he dropped from a tree and advanced to the center of the clearing, swinging his club in one hand.

"I am Lok," he said. "I have returned to rule the tribe."

The females scuttled behind the males, who formed a wide half circle of beetle-browed suspicion.

"This hairless one has a sickening smell," one said.

"Kill him!" cried another.

Lok moved a pace nearer. "Wait!" he commanded.

They were quiet.

"I have slain a big head," Lok said, swinging the club. "I am master."

The Old One stepped out of the half circle and advanced to within ten paces.

"Fish food!" the Old One yelled. "Coward! Go before I tear out your throat!"

He bounced up and down, as was the custom of fighters, on his squat legs and made his face as frightening as possible with wide, slavering jaws. Behind him the others emulated his example, howling and hurling threats. The clearing was in instant bedlam as the females augmented the cries and their babies clung to them in loud terror.

Into the midst of the insult and confusion, Lok stepped forward and swung his club.

Its sharp crack against the skull of the Old One cut all sound. The Old One brushed at his head with a hand as though driving away an annoying insect, and then fell like a shattered tree, his jaws and eyes still wide with anger.

Into the silence, Lok said, "I have slain the Old One. I am master."

They had not yet grasped the event and were quiet, save for the babies who whimpered softly.

"I have gone," Lok continued, gesturing, "far out there. There is a dry place safe from the rain and wind. It is good. I will lead you. There is food."

They stared at him with dull, uncomprehending eyes. For a long time there was no sound except for the babies and the far-off cries of birds while Lok stood in the center of the clearing with the

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dead Old One at his feet. Then one of the young males spoke.

"He has a smell I hate, this hairless scum."

The hate filled them instantly, and the entire tribe once more shrieked insults and threats of death. Some of the more foolhardy males rushed forward a few steps, and Lok's club slashed out the second life.

This brought another moment of quiet, and a big, gray female moved out of the ruck.

"Go!" she growled from foam-flecked jaws. "I, myself, will kill you!"

"Mother!" Lok cried. "I am Lok!"

"Mother?" she snarled. "Pink filth!"

"Kill him!" bawled half a dozen throats, and the males closed in.

Confusion and lust for death filled the air again as Lok backed away, swinging his club on the hairy beasts that crowded him with foaming mouths and screaming lungs. Each swing took its toll, and Lok remembered the lesson he had learned on the grassy plain. He struck each blow at a head, and the crushing skulls brought a tingling excitement into his arms and a wild exhilaration to his brain.

One of the larger males caught Lok by an arm and, as he bent to sink teeth home in the wrist, Lok took careful aim and shattered his head like a ripe fruit. The sound of its cracking cut sharply into the incoherent roars of the attackers.

"I am master!" Lok screamed, thinking of the split skulls. "I am Lok!"

And he swung again, and again.

When he was near the jungle edge, Lok's arms were tiring. The last three males he hit rose shakily to elbows and knees. Lok turned and fled. They were too many.

None followed. They returned to the still forms which marked the trail of battle, and Lok watched them try to shake life back into the dead for a time. Presently they tired of this, and the largest male called them into the forest. They trooped away, chattering lightly of drinking nuts, leaving the wounded to follow as best they might.

Lok's brooding eyes followed until they were hidden from sight and the sound of their chatter had faded. He looked then at his club, spattered with blood, and at the dozen dead which littered the clearing floor. A greater sense of power and superiority than he had felt before now flooded his being, but this was also tempered with a feeling of desolation.

For he was alone again. He who had returned to his own was driven forth once more.

When the first dead eater slunk cautiously into the clearing, Lok turned to go.

He had gone but a short distance from the clearing toward the far country of the caves when he heard a moaning off to one side.

He sprang aloft and sat quietly for a time, listening. The moans were repeated, and Lok moved nearer.

A female of his tribe was pinned lightly under a tree. Lok dropped to the ground and approached. She was unconscious, but after he had prodded her a few times with his club she opened her eyes and cried out with terror.

"I am Lok," he said.

She groaned again and tried to push the tree off her body.

Lok squatted on his haunches to watch. She strained at the tree in an agony of effort, trying to free her legs, but it was beyond her strength. Presently Lok tired of watching and turned away.

"Help me!" she cried after him.

He looked back with puzzled eyes.

"Help me!" she cried again in the words and voice of a baby to its mother.

Lok stood over her again and poked her with his club, shaking his head in bewilderment. She looked up at him with wide, dark, pain-ridden eyes which took in his smooth, hairless body.

"I am hurt," she whimpered.

Lok crouched again as she renewed her efforts to push away the tree. His brows wrinkled in concentration as he tried to focus his thought. He poked his club at her.

"You are alone, too," he said.

She grasped the club with both hands and pulled. Lok, in surprise, turned it loose, and she cried out in anger and pain.

The picture of her desire burst into his mind and he leaped to his feet, dancing with excitement.

"I am Lok," he chattered. "I slew the Old One."

He grasped his end of the club, leaned back on his heels and tugged. She clung to it desperately, and presently she slid out from under the tree.

Lok stood over her as she rolled and kicked her skinned legs, crying aloud in anguish. Now and then he poked her experimentally. Presently she tried to rise.

Lok sat on his heels and looked at her for a long time. She returned his gaze steadily.

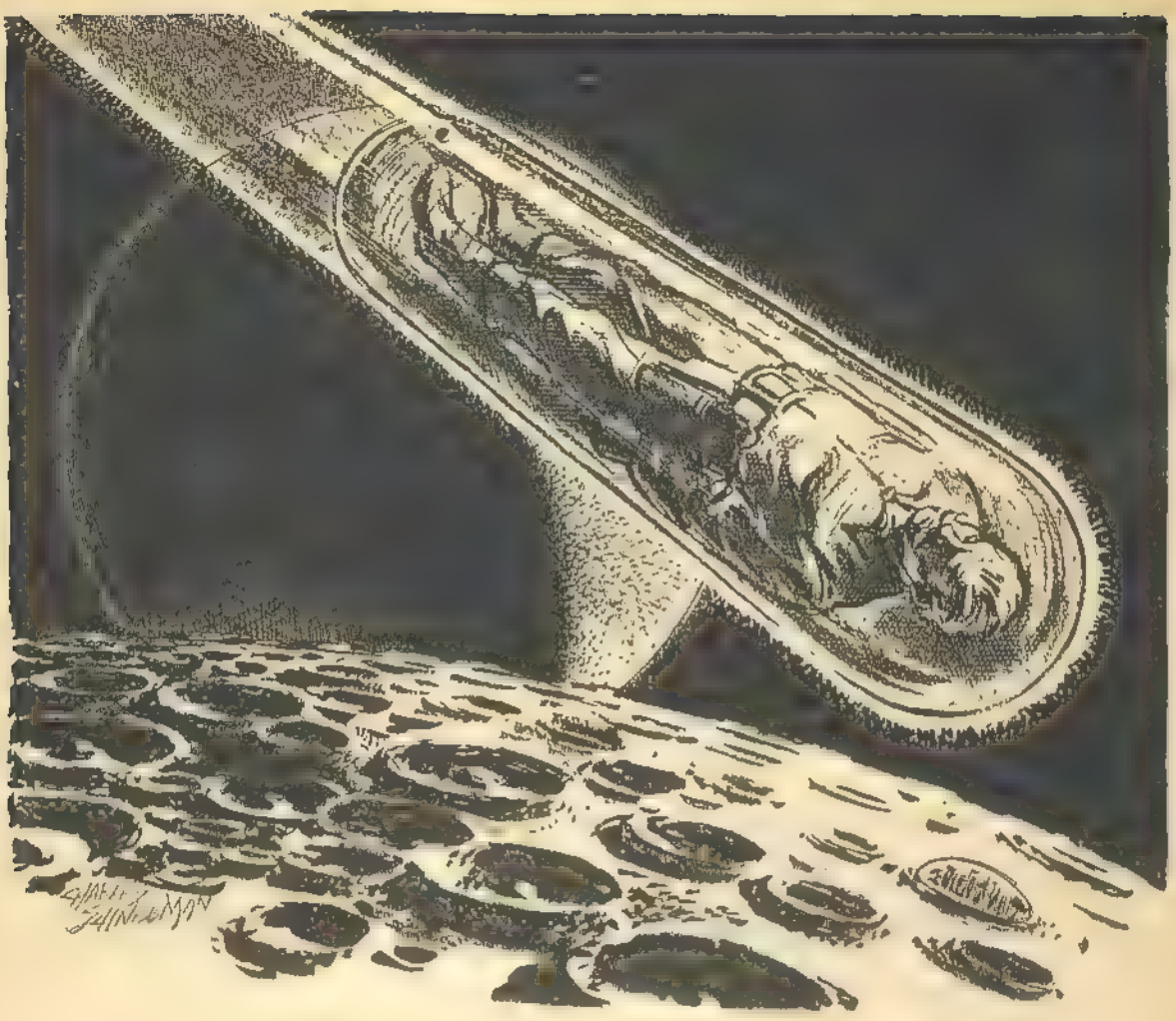
"I am Lok," he said finally. "I am master."

"Yes," she answered. "Yes."

Without understanding the deep calm which had taken possession of him, Lok slung her over his shoulder and began the long journey to the place of caves. As he trotted along the twisting trail, he swung his club now and then against a thick vine, feeling keen satisfaction at the sharp crack of the blows.

"I have killed a big head," he said proudly to the female, who clung to him tenderly. "I have killed a big head and—" he hesitated, searching his brain for a term to describe the dead he had strewn over the clearing "—and other animals," he concluded.

THE END.



KILGALLEN'S LUNAR LEGACY

By Norman L. Knight

● **A slightly whacky story concerning the legacy left in a more than slightly whacky family—**

Illustrated by Schneeman

It seems that once there were three Irishmen. The first one was a bit daft even when he was sober—which was seldom; the second one was also daft, but only when he was drunk—which was occasionally; and the third one was myself, about whom I have the discretion to remain silent.

The first one bore the name of Higggins. Perhaps one should say that he flaunted it. He was Irish on his mother's side, which was the only side that ever showed, barring the name. Concerning the three G's, more anon—as they say in books—when I come to the recital of certain happenings as narrated to me by his nephew, Orion Kilgallen. I am repeating it just as Orion told it, regretfully leaving out certain expressions which add a grand pungency to conversation but do not look well in print.

Orion was born in the constellation Taurus. You will mark that I'm not saying that he was born under the sign of Taurus; I mean that he was born *in* Taurus, on Aldebaran III. They would have named him Taurus but that would have

been open to uncomplimentary interpretations, so they did the next best thing and called him Orion, and anyway it sounds like O'Ryan. Even so, there's a subtle association of ideas in the name—a veiled reference to that rampaging beast of the Zodiac which is eternally threatened by the starry matador armed with club and sword.

The rugged frontier life on Aldebaran III gave Orion a fine contempt for the niceties of grammar and pronunciation, as you will soon perceive. When he was a mere lad the family immigrated to Earth, for personal reasons. I ignore the baseless gossip which has it that Kilgallen senior bashed the heads of three men with the detachable handle of a heavy-duty rheostat. It was six men, and they were each one bigger than he was.

Certain allusions in Orion's story will be clearer if you know in advance that he is an ace designer of toys and whimsical novelties—one of that horde of commuting workers who swarm back and forth between Earth and the Lunar manufacturing plants. At the time of which I'm writing, we both were celebrating the beginning of our semiannual vacation at Orion's mountain retreat in Kashmir.

As any sensible person knows, there's only one way to commence a vacation. We had scarcely emptied the first bottle—it was a queer bottle of red earthenware; you could just as well have called it a tall, slender sort of jug—when Orion happened to look through the bottom of his glass and saw the moon coming up and making a halo round the craggy head of the mountain Nangra Parbat. At the moment, you're to understand, we were launching our holiday in a glassed-in porch facing east, that jutted out over a great canyon. Underneath was bottomless purple-black shadow. Eastward, Nangra and all her sister peaks were midnight blue, touched and half outlined with vaporous moon white, like the heads and shoulders of veiled women against a back drop of stars.

After taking a long squint at the moonrise with one eye, Orion set down his glass and announced:

"This puts me in mind of my uncle Ophie."

Now I'm warning you beforehand, I'm making no claims as to the accuracy of the tale that follows. There are points in it which you can forgive a man for doubting. And you should know that Orion's veracity tends to vary inversely as his exhilaration. Be that as it may, this is his story.

I ain't never told you about my uncle Ophie, have I? His name is really Ophiuchus Higggins. He spells it with three G's, it bein' his opinion that Higgins with two G's is too ordinary to be hooked up with a extra-special name like Ophiuchus—an' if three G's ain't distinctive they ain't nothin'. Not to mention Ophiuchus. But usually people just called him Ophie.

Our family has been strong for astronomical names as far back as I know anything about 'em. Funny thing is they usually turn out appropriate—except mine. You can't make nothin' out of Orion. There has been some that tried to but regretted it. Take Uncle Ophie now. If you look on the old maps with the constellations all drawn in, you'll see Ophiuchus wrestlin' with a snake. It sort of fits in with Uncle Ophie's habits, only he didn't wrestle with no snakes when he was after doin' a bit of all-out drinkin'. He talked to 'em. Said he got a lot of good ideas that way. Myself, I'm not bothered like that. But if I do happen to see a snake or two once in a while I just let it take a good stiff pull on the bottle an' it coils up an' lays quiet, an' I can ignore it.

That'll give you somethin' of an idea of the kind of crackpot he was. But come right down to it, he wasn't no crackpot, but just fanciful in a unusual sort of way that was outside the orbit of most people's thinkin'. Everybody thinks in a orbit. Everybody, that is, but Uncle Ophie. He didn't have no orbit. He thought mostly, you might say, in spirals an' curlicues. An' acted the same way.

So I wasn't surprised when I heard that he'd sent me a will, by radio, from somewhere around Procyon, an' that I was heir to some kind of buried hoard. The wordin' of the will wasn't very plain as to what the stuff was; just said it was valuable. An' it wasn't as clear as you might wish about the location.

An' I wasn't surprised when Uncle Ophie located it for me in a indirect way. He was just the sort that you'd expect wouldn't pass into the Great Beyond an' stay put accordin' to what you or I would do. He'd be bound to up an' do somethin' you wouldn't expect of a common-sensible corpse.

Perhaps you think it's queer that he'd send a important dockiment like that by radio from Procyon, bein' as it would take about twelve years to get here an' for the price of postage he could've sent it a hundred times quicker, or even might've delivered it in person.

But there was reasons. In the first place he was sore at Earth; said he wasn't appreciated here. You see, he was a engineer, an' made good at it. He built the first big-scale cascade distillation vacuum tubes for fractionatin' isotopes, on the Moon, where you just have to build the tubes—the vacuum bein' provided free. Five thousand feet long they are, an' big enough to drive a truck through. That was the beginnin' of the Lunar industries. But every so often he'd sort of fly off the handle with a idea that made people raise their eyebrows. There was the time he had a scheme for warmin' up the polar regions. Had it all figgered out how you could pump sea water down a big shaft into the earth, an' it would come back up as red-hot steam. He was goin' to separate out all the stuff in sea water an' lay a grid of steam pipes under the ground. But he didn't

get nowhere with the idea. That was when he got sore at Earth an' moved to another place—a frost-bitten sort of world belongin' to Mizar, where he thought he'd get a sympathetic hearin'. But it seemed the people there—intelligent they are, but not human—like it cold the way it is an' deported him for disseminatin' subversive propaganda.

Then there was another reason—I think, knowin' Uncle Ophie as I do. I'll wager any odds he was thinkin' how dramatic it would be if he was dead before the message reached Earth. Voice from Behind the Veil, an' all that.

Or maybe he was merely drunk at the time.

I always was a sort of homebody—I guess that's why I ain't never been outside the Solar System since I was ten—an' Uncle Ophie knew it, an' must've figgered he could reach me here. I can imagine just how he gloated over the sheer daffiness of it—my legacy, ridin' the ether for twelve years between Procyon an' the Sun. Even if they'd had this here oskillatin'-gravity-beam idea worked out like they got it now, he'd have sent it by radio anyway.

Seems he heard about a survey bein' made, checkin' star distances by usin' a radio beam an' sendin' dated signals back to Earth, an' he fenagled one of the survey crews into includin' his will along with the routine stuff. The work was tedious an' the surveyors didn't mind workin' in a little comedy, so to speak.

But I heard about my legacy without waitin' twelve years. After it had been en route about three years a transport come along—a ship with a name like *Decameron,* or somethin' remindin' you of a boodore—an' overtook the broadcast. It run through Uncle Ophie's last will an' testament from the rear an' picked it up on its recorder. You know how most of these transports go around pickin' up old radio broadcasts that leaked out through holes in the Heaviside Layer an' are still goin'—just to humor the arkilogical big-brains. They tell me it was all bunched up on the recorder—they always are, since the ships are goin' so much faster'n the broadcasts—but they got a way of stretchin' the record out like a concertina an' readin' it.

Anyhow, one day comes a delegation of official high mucky-mucks to see me at the factory. When the ship made port the skipper turned in Uncle Ophie's will, since it ain't legal to bequeath nor inherit nothin' that gives you a unearned income. The boys in the delegation had come to notify me about it, an' to go along with me an' locate the "treasure." That was what they called it. If it turned out to be somethin' of "direct personal use or sentimental value," they said, I could keep it. Otherwise it was gover'ment property.

I still got the will around here somewhere. Wait a minute an' I'll be after readin' it to you.

After making a search of his quarters, Orion returned with a boot in his hand. From the boot he brought forth a sock. From the sock he extracted a folded green paper—without question an authentic official message form.

This is how it goes:

"I, Ophiuchus Higggins, bein' of sound mind an' in full possession of my faculties—disregardin' the aspersions of those who harbor opinions to the contrary—do hereby devise an' bequeath to my aimiable but mentally limited nephew by name Orion Kilgallen, certain valuable properties now in storage at a location hereinafter described.

"In the event that I'm still alive at the time this, my last will an' testament as regards Orion Kilgallen, is delivered to said legatee, it shall be construed as a transfer of title. In a word, it's a gift if I'm alive; it's a legacy if I'm not.

"Said properties will be found stored at the followin' location: On the yonder side of the Moon, satellite of the Planet Earth, Solar System, in the Mare Triangulum, on the lunar meridian passin' through the center of Tycho an' produced across the pole to its intersection with a line drawn across the Mare Triangulum from the apex of Cryolite Dome to the lowest point of the gap in the Cinnabar Range. The two latter landmarks are plainly visible to a observer on the ground near the indicated point. I have lost my notes (he would that) givin' the exact location, but I think that this gives it within half a mile.

"The stuff is in a cave about twenty feet under the surface. I've had the entrance oblighterated. You can locate the cave by drillin'. When you come to a place where you drill down about twenty feet an' hit nothin', then that's it."

That's all of it, except his signature an' some stuff about witnesses. One of 'em was a Martian named Ilrai.

So I get a leave of absence from work an' go out with this search-party in a cruiser.

Besides a couple of gover'ment lads from the Treasury there was a official geologist with his detectin' rig an' some helpers, an' a official photographer, an' four or five newsmen. The geologist was all keyed up because Uncle Ophie mentioned drillin', an' he thought that maybe the will was a sort of cipher an' the treasure was oil. He said nobody had ever found oil on the Moon, an' if they ever did it would mean there had been a Coal Age there, an' it seems everybody says that ain't possible. There was some other people along, too, but I forget who they was.

It wasn't no trouble to find the Mare Triangulum, no more than Tycho. But "the center of Tycho" is a bit vague when you come right down to it an' want to draw a meridian through it. So is "the apex of Cryolite Dome," which has a irregular-shaped flat place on top coverin' about forty thousand square feet. So is "the lowest point in the

gap in the Cinnabar Range," which is different accordin' to where you're lookin' at it from. Uncle Ophie was way off when he thought his directions located the spot within half a mile; what they located was a area of about twenty square miles.

In four days' Earth time we worked over about as many square miles an' found three caves with the detectin' rig, but they was all the wrong ones. After drillin' into them the way Uncle Ophie said, an' after no oil comin' out the way the geologist was hopin', we blasted into 'em an' found no more than you'd expect. That is to say—nothin'.

Except the last one, which already had a entrance which we didn't see till after we blasted an' went in, an' people had already been in it before. Someone had wrote up on the wall, "Big Feet Joe is a Sappodillo," an' down under it in a different handwritin' an' big angry letters was, "SEZ YOU." An' in another place somebody had cut in the rock with a chisel, "Giovano Parelli, Class of 2587."

On the fifth day we found it. Now maybe you ain't goin' to believe this part, an' I'll not hold it against you if you don't, but I'm givin' you my oath—by the moonlight on Nangra Parbat over there—that I'm tellin' you nothin' more nor less than what happened.

We had run a long line of rock soundin's without findin' no more caves, an' were movin' up to make another—the cruiser then bein' at an altitude of around one hundred feet—when we seen somethin' fall on the Mare Triangulum, which is flat as a pancake, barrin' gas-vent beehives an' meteorite furrows an' what-not. From where we was you could see clear to the snags at the base of Cryolite Dome. I was up in the navigatin' cabin with the skipper.

This fallin' object come down about two miles away, on the side of us away from the sun. It was movin' very slow for a meteorite. You could see it comin', like a streak of silver reflectin' the sun, an' it was travelin' almost on a level course. It come through the gap in the Cinnabar Range an' skimmed the Mare Triangulum, an' finally grounded.

But it kept on goin', throwin' out two waves of pumice dust like a speed boat plowin' up water, an' then it went all to smithereens—like diamonds explodin'. There wasn't nothin' left of it but glitterin' hunks an' pieces. As we eased over to have a look we seen a spot of green in among the sparklers. It turned out to be the body of a man dressed all in green, savin' the linin' of his cloak an' the feather in his cap, which was silver. Near as we could tell from the bigger pieces, the thing we had took for a meteorite had been like a solid crystal cigar with a form-fittin' hollow inside where the man had been. There the body lay, all spread-eagled. But here's the point: It was the spittin' image of Uncle Ophie.

He was in astonishin' good condition, which wasn't right at all. You know what happens to a cadaver that lays out in the sun, on the Moon, even a few minutes. It puffs up an' turns a brownish blue. This one had a good color, an' not a scratch on it, an' that's a fact.

After we brought the body aboard, the ship's doctor give the supposed corpse a goin' over an' found they wasn't the remains of Uncle Ophie at all—just a reasonable fake-simile made out of Impervia, the same stuff that spacesuits is made out of. You might say it was more than reasonable, seein' it was built around a real human skeleton. But it didn't seem like it could be Uncle Ophie's skeleton, since it had this placard sewed on the back of the cloak:

If found stranded, please notify Ophiuchus Higggins, mailing address Central Delivery, Central Post Office, Planet Alcorhaven, Alcor System.

Well, we'd found it stranded an' no mistake, so after we found what we was lookin' for—I'll be comin' back to that in a moment—I wrote Uncle Ophie an' we corresponded for a while an' then he stopped writin'. I don't know where he is now or even if he's livin'.

But here's what I found out. It seems Uncle Ophie got a fanciful idea that, instead of bein' buried or cremated in the usual way, it would be more impressive to have his mortal remains shot off into space in a air-tight flyin' casket, so he could revolve among the stars forever an' become one of the heavenly bodies. But after thinkin' it over he decided he ought to be holdin' a trial burial—a trial launchin' would be nearer to it—to test out the idea. The theory bein' that if he had a fleet of these pioneer dummies, as you might call 'em, shot off from different points in space an' then waited awhile, he'd know what the chances were of his own astral coffin bein' grounded somewhere. If it turned out the odds was against his revolvin' among the stars forever, the way he wanted, he was goin' to abandon the notion.

He insisted on havin' these coffin proxies of himself made very careful, regardin' size an' distribution of weight, so they would act in transit just as if they was him. That was why he had a real skeleton for a foundation. He had twelve of 'em made an' launched, owin' to a scientific supply house givin' him a special price on a dozen skeletons.

I ain't heard of no more of 'em being picked up.

Goin' back to where I left off, it come over me that findin' Uncle Ophie's dummy deputy like that was a sign. It meant that where we found it was the place we was tryin' to locate. So the geologist took a soundin' an' sure enough there was a cave under the spot.

This time Uncle Ophie's will was wrong even

when it was right. You'll remember what it says about drillin' about twenty feet an' hittin' nothin'—meanin' the cave. Well, we drilled down twenty-two feet an' a half, if you want to be particular, but we hit somethin'. I was standin' about twenty feet from the drill when I felt a *chug* under my feet an' the drill shot up at least fifty yards on top of a foamin' brown stream of liquid. Everyone scattered immediate, takin' long kangaroo jumps like you can on the Moon, an' lookin' up to see which way the drill would be after fallin'.

Everyone but the geologist, that is. I could hear him in my helmetphone, shoutin', "Incredible! Incredible!" an' saw him runnin' toward the gusher with a bottle in his hand.

By just grazin' the stream with the mouth of the bottle he was able to collect a sample, but he got his suit sprayed somethin' pathetic. He was drippin' with the stuff when he come away.

I ain't no authority on petroleum, but this stuff didn't seem to me to be actin' accordin' to the nature of crude oil, even when you allowed for there bein' no atmosphere, an' for the rocks bein' almost boilin' hot under the lunar sunshine. In the first place it wasn't dark enough nor thick enough. When it started comin' down an' landed on the rocks it just fizzled an' boiled off into space an' left nothin' but a thin brown scum behind. Just about what you'd expect of dirty gasoline—not crude oil.

By the time we got back inside the ship with the sample, the gusher was dyin' down to a splutter. And as soon as I took my helmet off an' got a whiff of the geologist's suit I *knew* it wasn't petroleum. It was whiskey!

That started a loud, arm-wavin' argiment. I said it would be wastin' time to have the stuff analyzed. I can tell whiskey when I smell it. The geologist said it couldn't be whiskey because whiskey ain't somethin' that occurs in nature, an' that it had to be a sort of lunar petroleum that just happened to look an' smell like whiskey—even he couldn't deny that it did—an' which might even be fatal if we drunk it. Me an' some others was all for takin' a chance.

The argiment was settled by the newsmen. Without sayin' nothin' to nobody they had left the ship again an' dipped up some more of the fluid—by then it was bubblin' quietly, like a spring—an' had come back in again an' tested it the right way. They was not only not dead but feelin' grand. They told the geologist he was a sappodillo—that word took their fancy at first sight—an' that they didn't pin no faith on his lunar petroleum idea. The stuff was whiskey an' no mistake, they said; an' if whiskey comes out of the ground it has to come out of a tank or somethin', they said; an' that all we had done was drill into a larrupin' big storage tank full of whiskey. Furthermore, they said, that very likely there was more of it in the cave, an' they recommended lookin' for the entrance which Uncle Ophie said was oblighterated an' goin' in that way like gentlemen—not blastin' our way in an' takin' the risk of spoilin' a stock of good liquor.

So we did that. The entrance was sealed with vitrolith with boulders piled on it. Underneath is a shaft with a steel ladder in the side which takes you down into a museum of wines an' liquors which I'm willin' to wager ain't got no equal between here an' the Milky Way. There's drinks in that cave from every known planet where the people has reached the drinkin' level of intelligence, in every kind of tank, keg, crock, jug, bottle, an' flagon you might think of—an' some you might not. It made me feel sad to look at it, knowin' well enough I couldn't no more than scratch the surface even if I lived to be two hundred.

Before I could touch a drop of it I had to be waitin' three weeks for the official rulin', to wit: The estate is bein' held in trust for the rest of my natural life, me bein' allowed every six months to draw out a reasonable amount for myself, an' for entertainin' an' gifts. Any remainder that I'll be so misfortunate as to leave behind will go by public auction, the gover'ment gettin' the proceeds.

This arrangement is partly owin' to my supervisor at the factory—the scoundrel. He had to put in his two cents' worth, sayin' that if I had free access to my liquid assets he'd lose a good designer—which is true, although understatin' it some—whereas if it was rationed out so I had to make it last, an' allowin' for a burst of glory every six months, I'd have more an' better ideas. An' that's a fact.

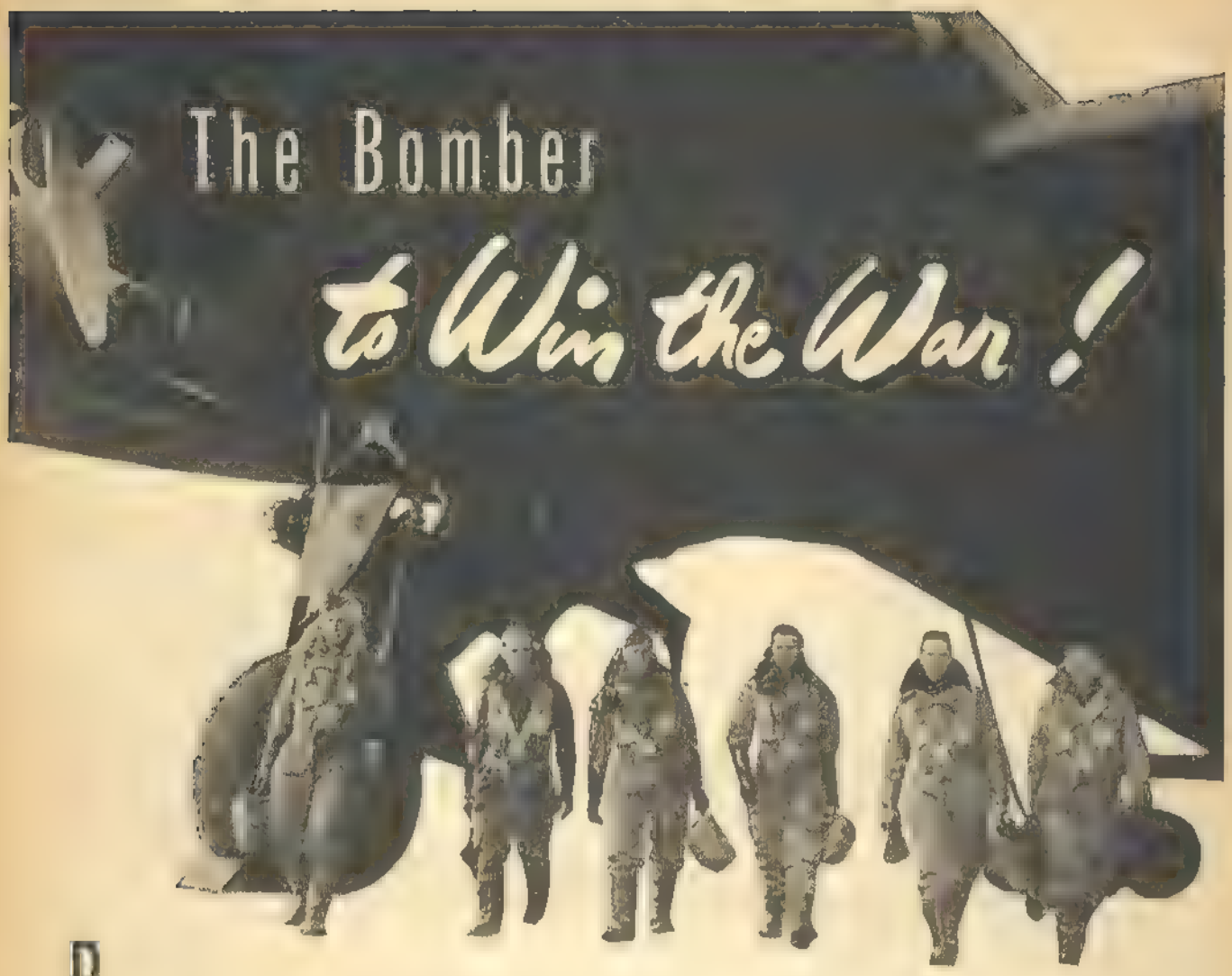
There you have it—the full particulars regarding Orion Kilgallen and his alcoholic Golconda on the yonder side of the Moon, marked—not by an X—but by the simulacrum of Uncle Ophiuchus Higggins, which cracked up in its flying streamlined crystal sarcophagus right on top of the Bacchanalian treasure-trove.

While Orion unfolded the foregoing account we had made inroads on the second bottle. It was rotund, squat, blown of azure glass with a side neck like an alembic, and stood on three triple-clawed feet.

Kilgallen tipped the bottle, filled his glass, and proposed a toast, with a note of defiance.

"To the Truth: May no man say I ain't never always told it."

THE END.



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IN TIMES TO COME

For the past several months, I've been somewhat busy. In addition to the usual job of getting the magazines together, there's been a problem of getting some new authors together, and helping some almost-but-not-quite writers into the pretty-good division. The top line of Astounding writers were, all of them, highly intelligent men, and men with real engineering training. As previously stated, L. Ron Hubbard and Robert Heinlein were both regular navy men. With the outbreak of war, they were in, and Astounding out two top writers automatically. In rapid succession since, we've gotten word that "This one's probably my last for the duration" from Anson MacDonald, L. Sprague de Camp and Isaac Asimov.

Schneeman was drafted in the spring of 1941, released as one of the over-twenty-eight group in the fall of '41, and, of course, taken back after December 7th. Cartier went in late last fall. Rogers is in the Canadian army now.

Interestingly, no author has gone into the army —they're all either navy officers or employed as civilian experts. Dr. E. E. Smith is in that latter class, I hear—but he is still able to do some work on his next novel.

But that's meant a considerable bit of hard looking for new authors. (Anybody got any good stories they'd like to write?) The search goes on, naturally, but three new writers in particular look very promising indeed. Will Stewart's "Collision Orbit" you've seen. He has more, and good ones, coming. Lewis Padgett's "Deadlock" appears this month; he has several more short stories and a novelette coming. They're good. Hal Clement's "Proof" and "Impediment" show real promise; he has other business to keep him occupied, however, and may not produce as much as I'd like.

How long some of our other top writers will be with us, I can't tell. Astounding is, characteristically, authored by young men, with engineering training or, to a somewhat lesser extent, newspaper training. (Van Vogt, Simak, Cartmill and Wentz, for instance, are newsmen. Heinlein, De Camp, Hubbard, MacDonald, Asimov, E. E. Smith have engineering degrees of one sort or another.) Inasmuch as the army and navy are both in need of young men with engineering training, there tends to be a certain overlap between Astounding's author group and armed forces' needs. I feel that that imagination Astounding has called forth from these men may, very genuinely, help do the job we've got to clean up—the flat and final destruction of the forces of brute wants so neatly epitomized in Hitler's and Hirohito's hordes.

They want change, but change backward, back to simple, primitive things low-order minds such as they represent can understand—the master and the slave.

Well, for a time they'll get it—that brute action, force and death and treachery. The old saying "It takes two to make a quarrel" is obviously a wish, not a fact; they've made the quarrel—we'll end it. And in what measure we of Astounding can, we'll help.

But for the immediate question, our next issue. We have an author who is new to Astounding, but far indeed from being a new author. Anthony Boucher is probably well and favorably known to many of you as a detective story writer; he's been writing for *Unknown Worlds* for about a year now. Next month he has the lead long novelette —"Barrier." An ingenious explanation of one of the old and well-known problems of time travel; if anybody anywhen ever invents a time machine, if it ever in all the history of the world yet to come is possible to travel in time—why aren't there any time travelers around? Since the history-yet-to-come extends to plus infinity, it seems necessary to assume that time travel is forever impossible—or that Boucher has the right answer. His solution is complete, workable, and very possible.

Also present is Lewis Padgett's short, "The Twonky," a neatly nasty bit about a radio set from the production department of a standard manufacturer, that had peculiar habits. It washed dishes, cleaned house, lit cigarettes—and censored the morals of its owner. It also—well, it's a good little nightmare.

Lester del Rey, one writer who irritates me considerably by being a darned good author who refuses to write regularly, has another long novelette coming up next month—"Nerves." Centers around an industrial medico under explosive circumstances. He works for National Atomic Products, and one of the products goes wrong in its atomic furnace. The problem that really worries them is whether the explosion, when it comes, will remove a fifty-mile circle, or the entire Eastern seaboard—or whether the doc can bring back to consciousness the one man on Earth believed to be capable of quenching the wild atomic fire.

The Editor.

PROBABILITY ZERO!

Calling All Liars!

TIME MARCHES ON
By Ted Cornell

Down in the jungle that was Central Park a glowing wood fire leaped and flickered, throwing into weird relief the faces of a score or so men and women, some well dressed, others in rags.

Yes, they were practically all here, thought Doc Smith, as his gaze moved from one to another of the circle. Williamson, Miller, Hubbard, Bond, McClary, Rocklynne, Heinlein and MacDonald, and many others who had once written about the mysteries of time travel—so many hundreds of years ago now.

"So—we were all wrong," his low voice broke the depressing silence. "We always thought that if time travel became possible it would necessitate some vast complicated machinery and unheard-of power." His audience stirred uncomfortably. "Instead," he chuckled, "those two science-fiction readers Pimple and Parke stumbled upon the secret that was right under our very noses. Micro power!"

He pointed to the metal bands that they all had clasped round their waists. "Now that you are somewhere in the twenty-fourth century," he went on, "you know those belts work only too well. Many of you have seen the desolation that is now New York, that same desolation that must stretch across the entire planet. Nowhere does Civilization remain, as we knew it, because—"

"But where *is* Civilization?" broke in one of the group.

Doc settled himself more comfortably against a tree. "When Pimple and Parke discovered that they could travel forward in Time—you remember that they proved their theories at the Exhibition in New York in 1943, by vanishing before a large audience and reappearing several days later—they then decided to go some hundreds of years into the future to find the Utopian world they hoped would have materialized. They left behind for posterity all their notes, and as you are aware, the Pimple-Parke Time Traveling Belt is simplicity itself. Anyone can make one from the parts of a radio set.

"That was the trouble—it was too simple. Other people, tired of their way of living, or loaded down with trouble, found an out in Time. The idea caught on. Murderers and would-be suicides hopped off into the future. Police departments and F. B. I. men went after them. More and more people began to blaze the trail. Radio dealers began to sell the belts as fast as they could be made. The idea spread to the warring armies. When one side found nobody to fight, they themselves went into the future. In all the main cities travel agencies were running excursions into the future.

"Within a year it had become almost a mass hysteria to go into the future. Within two years, that is up to the time that I left, practically the whole of the North American continent had become deserted. Humanity as a whole had trekked into the future to find a better world, forgetting that they were the seeds of that better world, and that with their passing they had left nothing behind for the future to be built upon—for we now know that we cannot travel backward in Time.

"Now—well, Civilization is probably strung out over a period of thousands of years, even greater than that, for as time travelers arrive in these desolate places they again travel forward, always seeking the millennium—little knowing that there is no millennium—nor can there be! Unless—"

He paused and looked round the expectant faces. "Somewhere, some people must start building again, must forget about time travel, and as

the people from the past arrive, they must be conscripted into helping remodel Civilization—our way!" His gaze rested upon McClary. "Three thousand years," he murmured. "I wonder—"

His conversation was cut short by a crashing in the undergrowth, and two tattered figures staggered into the fire light.

"Thank heavens we've found some humans at last. Where is everybody?" one of them asked, as he peered round the dim-lit glade. "My name is Pimple and this is Parke; we've come from the year 1943—"

They buried them beneath a gnarled oak tree.

THE IMAGE OF ANNIHILATION

By Jack Speer

Those old-time science-fiction stories of worlds within the atom make good reading, but nobody nowadays believes that electrons are really little particles of substance. I am privileged to supply final confirmation of the truth of the wave theory —you know: the idea that electrons are just etheric vibrations, like eddies in a stream of water. The results I secured by working on this hypothesis admit of no other conclusion.

It is well known that in the case of sound—which is a vibration of the air, similar to vibrations of the ether like light and radio—when two sound waves of certain pitch are superimposed on each other so that the crests of the one fall exactly on the troughs of the other, they will automatically cancel out into silence. It occurred to me that I might be able to do the same thing with etheric vibrations, producing in a restricted area an utter absence of light, radio, and even matter.

It was a simple thing to give a metal mirror a special coating to slightly change its reflecting properties so that it would reflect back the vibrations of material electrons, and a mechanical device on the back of it permitted bending the mirror out of focus except when I wanted to use it. Now, the reflections of the electrons directly in front of the mirror were exact duplicates of the original electrons, except that they came back upon them in reverse order. Naturally, the two waves canceled each other out.

The first time I tried this, it cut a narrow swath across the countryside halfway to Chesapeake Bay before the curvature of the Earth left it behind. And it gave me a funny feeling in the pit of my stomach when I read a confidential war department report from the sole survivor of a blimp that had been hunting submarines offshore. After that one experience, I learned to confine the action of my electron-mirror with a second mirror placed opposite it.

Of course I sent a description of the thing to the government, and in due time—six weeks later —got back a letter from the adjutant general's office stating that:

(1) My suggestion had been carefully examined, and was considered to have insufficient promise of military value to warrant the expenditure of war department funds in its development;

(2) The idea was not new, having been presented to the department in various forms over the past several years;

(3) It was not as effective as other means for the same purpose already available to the armed forces;

(4) My suggestion had been transmitted to the National Inventors' Council, department of commerce, to whom any further correspondence on the subject should be directed; and

(5) My interest in national defense was appreciated.

This left me free to use the discovery as I saw fit. I'll not dwell on the minor uses I made of it, such as trimming hedges and disposing of old razor blades and bill collectors. A rereading of Doc Swisher's article "What Are Positrons?" in Astounding some seasons back got me started on a new line. The doctor, you will recall, showed that the "ether" that "waves" when we have an etheric vibration is actually made up of a continuous mass of electrons in negative-energy levels—Dirac holes. Well, it occurred to me that if I could obliterate electrons in positive-energy levels, I certainly ought to be able to do the same with Dirac holes. And with a slight modification of my mirror surface, so I did.

The result of my first successful experiment along this line was a cubic meter of nonspace, a warp in which anything put in on one side *immediately* reappeared on the other side, because there simply was no space in between, although an onlooker would swear that more than a yard separated the ingoing point from the outcoming. When a wheel on an axle was placed so that part of one side of the wheel ran through this warp, the unbalance thus set up started the wheel to spinning. It would have been perpetual motion if the thing hadn't kept accelerating its revolutions till it flew apart.

Anyway, I had a bigger idea by this time. I worked a hole through space three hundred eighty-five thousand kilometers long, making an instantaneous short cut from my back yard to Crater 17, near Tycho. Providing myself with a diver's air helmet, I stepped through this channel onto the Moon's arid surface, where the Lunar natives mistook me for their long-lost god returned to them and— But that's another story.

DESTINY AND UNCLE LOUIE

By Joseph Gilbert

My uncle Louie always had been the impractical member of our family. He wanted to be a mad scientist.

Instead of turning his inventive ability to something profitable as I have done—you know, of course, that I devised that sensational and world-famous invention which completely did away with unemployment; a machine that took a hundred men to do the work of one—Uncle Louie spent all his time thinking up new and novel ways to conquer the Earth. Once having obtained domination of the world, he was quite sure he could hold it if the heroes pitted against him were like those in the science-fiction magazines, since he had taken a correspondence course in hypnotism that enabled him to put in his power any mentality under moron level.

Just before his tragic death he told me the stories of his experiments. He started out, it seems, literally in a big way, with giant ants. "They collapsed in on themselves, of course," he said moodily. "Inverse variations, you know—the cross-sectional area of the beasties' legs increased only in proportion to the rest of its body, and the darn sissies couldn't support their own weight. Had a deuce of a time explaining the bodies to a garbage collector."

Uncle's next invention was a faster-than-light spaceship, with which he intended to drop stink bombs on the Earth's inhabitants. He made, however, a trip around the Universe in his ship first, and thus discovered its fatal weakness. The dang thing was *too* fast. It zipped around the Universe so swiftly that it came back and smashed into itself before it had a chance to get started!

"A close thing, too," he told me. "If I hadn't had a parachute along, I probably would have died out there in space."

I said incredulously: "In space? How did you manage to live in space long enough to reach Earth's atmosphere?"

"Oh, I had my winter underwear on," he explained casually.

I was present when his third and most successful experiment was begun. Had it not been for one small accident, the superman he made might have enabled uncle to achieve his ambition, and get a biographical write-up in the Sunday supplements.

Uncle threw a switch there in his darkened laboratory and a deafening din shattered the silence. The mass of weird machinery that filled every available space purred and whizzed and roared, while electricity flashed and flared, sending monstrous shadows dancing on the white walls. Actually, all that was needed was a storage battery, a bent hairpin, a flask full of fish glands, a pint of corn liquor and a dash of mustard, but uncle figured that since he could get the gadgets so cheaply from the producers of motion-picture serials, he might as well make things look impressive.

It took a day or so for the artificial superman he created to finish cooking, so I had to get the news of the superman's fate secondhand, from the newspapers. It seemed that he had run amok, pelting innocent bystanders with marshmallows, and had struck three hundred four and one-half people with these vicious missiles. (The one-half was a midget.) The last seen of this man-made superbeing was on the Brooklyn Bridge. Here he threw a saddle over himself, and with a hearty "Hiyo Neptune!" had dived into the ocean. His body was never recovered.

This last failure broke my uncle's proud spirit. "Stinky," he confessed sadly—the family has always called me Stinky since that day in my childhood when I had dragged a pretty striped pussy from the woods—"this last failure has broken my proud spirit."

I am afraid that my curiosity eclipsed my sympathy. I wanted to know the reason for the superman's inexplicable suicide and said so.

Uncle sighed. "It was the glands I used. They came from a sea horse."

THE ANECDOTE OF THE NEGATIVE WUGUG

By L. Sprague de Camp

Some comment was aroused by the recent publication of the Drinkwhiskey Institute's annual financial statement, which concluded with the curious entries: Assets, plus or minus infinity; Liabilities, plus or minus infinity.

The reason for this odd state of affairs goes back to the Institute's Siwalik Pleistocene Expedition of 1932. It will be recalled that the financing of the expedition was to be accomplished by bringing back a pair of wugugs, *Vugugus jonesiii*, which we planned to sell to the Grand Ducky—I mean Duchy—of Liechtenstein.

The Liechtensteiners, as everyone knows, are inordinately fond of goat's milk. But the little principality has recently been visited on three successive years by terrific hailstorms, hailstones the size of cantaloupes being reported. (One observer described a hailstone the size of a pumpkin, but upon investigation the observer turned out to be a member of the Fortean Society.)

These three storms had greatly damaged the Liechtensteiners' goat herds; in fact each storm had killed ninety-eight percent of the goats. As may be imagined, this did not leave very many. The government of the Duchy hoped to replace their goats by wugugs, which would be impervious to storms because of their thick carcasses, and would furnish milk of equally nutritious quality.

The wugug combines the characteristics of the goat and the armadillo. For a long time it was thought that wugugs were actual goat-armadillo hybrids. An attempt to produce such a hybrid experimentally broke down when the billy goat used in the experiments became highly incensed

and insulted, even quoting the Book of Leviticus to shame the experimenters.

We, therefore, set out for the Siwalik Pleistocene with orders to capture a pair of the beasts. This we did, largely with the assistance of the astral body of the Yogin of Swettypore, India, who had preceded us in our time-journey.

Unfortunately the animals died of old age on the return trip. The skeletons arrived in 1931 intact, however, and a careful study of the skulls revealed that they belonged to the Edentata. They were, in fact, related to the pagolins, in the way the Pleistocene glyptodonts were to the recent armadillos.

We, therefore, inferred that all we needed was a supply of modern pangolins and time in which to turn them into wugugs by selective breeding. The Grand Duchy agreed to this scheme, and offered us a round sum of one hundred thousand dollars for the finished product, subject to a three-percent-per-annum discount for the time from the signing of the contract to the delivery of the wugugs.

The Drinkwhiskey Institute accepted the offer with alacrity. We then imported a number of pangolins from Malaysia and set to work, with X rays and all the other modern appurtenances of rapid selective breeding.

After we had been engaged in the experiment for some time, one of our staff thought to extrapolate the known rate of change of our particular pangolin phylum to see how long the process would take. To our dismay, the time turned out to be in the neighborhood of ten thousand years.

Nor was that all. The Grand Duchy of Liechtenstein, getting wind of this fact, presented us with a bill for $\$100{,}000 \times 2^{450}$. This was, they explained, what we should owe them as a result of the accumulation of that three-percent discount over ten thousand years.

The Institute was in despair until the director appealed to the courts. The judge, a sensible man, demanded to know just what the amount $\$100{,}000 \times 2^{450}$ was. The Liechtensteiners were compelled to admit that they had not computed the exact amount, and, moreover, that the bill was not even accurate as stated, but had been arrived at by a rough calculation on a slide rule.

The judge accordingly ruled that "there is nothing in the United States Constitution or in the laws and constitution of this State which requires a debtor to calculate the amount of his indebtedness by solving a formidable mathematical puzzle, nor to translate his bill from the Sanskrit language, nor to apprehend the amount of the debt by reading the contents of a sealed envelope by ESP. This court will, therefore, honor the plaintiffs' bill when and only when it is presented in finished and completely solved form."

The last the Drinkwhiskey Institute heard, the Liechtensteiners were still calculating. But until the results of their efforts are known—if they ever are—we cannot logically issue other than a completely indeterminate balance sheet.

THE END.

BRASS TACKS

Post-war world. Science-fictionists should have ideas on that subject.

Dear Mr. Campbell:

Your editorial in the June Astounding is far too interesting to permit anything short of immediate consideration. This aspect, the post-war problem of too much wealth, has been overlooked a great deal more than it should be in the various concepts of the world situation. However, you were forced to leave off, for the sake of space, the fact that this problem is but a minor phase in the whole scheme of things; that is rather apparent. Lined up with other problems, a great many of them of international origin, this amounts to so shockingly gigantic a conclusion that it seems too much for even the most imaginative and optimistic of us to swallow.

One of the most intriguing facts about things as they stand, though, is the public's reaction. Not as during World War I is the war fever so manifest today. In its place is grim determination, and quite plainly! Nor does the general public appear to be heading toward any desire to go back to the old "status quo" as was the case before. Instead, they realize somewhat that this post-war situation will demand something utterly *new* and practical which will solve the problems of our sociology in a satisfactory manner, so that mankind may continue its little jaunt into a better era.

Liberalism is, therefore, gaining much more popularity than conservativeness. As a matter of fact, it's been doing just that ever since the beginning of what history we know of. That must be because liberalism is an attitude which satisfactorily solves the most problems—that is, if your definition of "liberalism" coincides with mine, it does.

The greatest obstacle, seemingly, to this end is the fear most of us have of facing the future. We're afraid it might become something radical, like Communism, plutocratic dictatorship, or some other of the many radical possibilities. (This

brings up another little problem: what about post-war Russia?) It might indeed result in just that, if we all were suddenly stirred to riotous action and ran pellmell into things. Since we're not overly enthusiastic, the obstacle becomes an asset. (I've heard that Communism is based on a nationalistic fear of some threatening power outside the nation. In that case there is a fine possibility of revolution of some sort within post-war Russia!)

Canceling out the radical contributions, of course, means the disposal of any ideas of a "World Order," such as H. G. Wells once set forth. It also eliminates any notions of the United States dominating the world by force to "preserve peace." A thumbs down on such pipe dreams is definitely preferable. None of them follow the ideals of democracy—which is, incidentally, proving that it *can* work, and a lot better than the Nazi rats and their "torpedoes" ever dreamed it could—and most of them demand that democracy be eliminated in one way or another.

That's what we're fighting *against*. To accept such a proposal after the physical battle is over would be as asinine as surrendering to the Japs—right now! What those guys out on Wake, Bataan, and Corregidor died for is the "four freedoms," for every blasted biped on this cantankerous planet—we hope. At the present moment it's on the house. This something utterly *new*, then, must be within the scope of *free* men.

There has been some small debate about Socialism. This does have its good points, but to adopt it altogether a nation must have the essential environment and nationalistic interest deep in its people. China is an example: millions of people living directly off the land; people who need the commodities afforded by industrialism; and a national spirit which is far more than traditional by thousands of years.

The United States is certainly *not* an example. Our individualism, our deeply rooted private capital show that. We would be only inherent to the bad results of Socialism. Government control of public utilities is acceptable, perhaps even preferable, but government management of the factories, the corporations which are our essential bread and butter, is something else. Though we do hold sway over our government, we don't have the civic nationalism to keep it completely under our thumb. As a result, our business and politics wouldn't mix so well.

This doesn't mean that we will never be in a position to adopt Socialism. Publicly-owned corporations with elective executive boards, civil-service employment, and covering all essential fields of production would be of great value in *competing* with privately owned corporations and advocating fair prices, increasing quality of products, and reasonable profits. Later on, when we have gained the sufficient education to fully realize the scope of the civic responsibilities we have, we may, and most likely will, be effective enough in our handling of the tools of democracy to take such a step. But the most appealing factor of such a plan is that it does *not* liquidate private ownership nor Capitalism. Though Capitalism, in spite of its initiative, may have its faults when economic royalties are involved, it is the proven system with which nations are built up from frontiers. There will be further use for it in the interplanetary colonization which so many scientifiction fans consider not so far off.

Other facts to be considered are the relations with other nations and the possible bearing this will have on our own welfare. It's quite apparent that once the Nazi machine is destroyed, whatever system of distribution there is within conquered Europe will evaporate. England has practically exhausted her supplies, and her factories are feeding the war; we're feeding her. Millions, there in Europe, and over almost all the rest of the world, will need to be fed and clothed, given medical care, supplied with a new "economic backbone" and provided with the facilities—factory machinery, et cetera—to get back on their feet. Thus we won't find ourselves faced so much with the problem of consuming three times as much as with the problem of putting a world back into its progressive state—and preaching a little of the doctrine of democracy, if necessary, for good measure. And this won't be done overnight, either.

Other nations will provide a good market for our excess production, but for us to profit by it they must have something with which to pay us; thus, if we are helping them build their industries, we must be sure that they will produce something of value to us. However, the fact is that anything they produce, no matter what it is, can be of immense value to us. Such mass production as we are experiencing will call for a considerable amount of post-war merging of corporations. Competition will be lessened to a dangerous degree; small independent businessmen will be in peril of extermination. More competition would be needed. Q. E. D., to open trade between the corporations of this country and those of other countries would invite new competition.

This in turn demands a number of large changes. All countries concerned would have to have a standard wage scale and social security rate. It would practically necessitate an international monetary system. The problems of trade would be even more complicated. Trade agreements or treaties governing tariffs would be next to absurd. Free trade would be much more effective. And free trade demands a good deal of international co-operation. It might have the power to gain that co-operation, since trade has always been the "international language."

Another League of Nations won't do. Nations

aren't so willing to sacrifice for each other, and it's too easy to back out once the going gets rough. Besides, it doesn't answer the requirements of promoting a real peace. To do this, we must have a world police.

The latter immediately brings to mind the Gestapo. Police aren't considered in the light of what they do to uphold peace and justice in our communities very often. In this country they are servants of the people. Any sort of world police would have to be the same. Say, for example, that the R. C. M. P., the F. B. I., and Scotland Yard were combined. It would have to be something like that all over the world. This is the only way as I see it to eliminate the use or maintenance of armed forces and weapons of war.

But to have such a world police, you must have an agreement on principles between nations. To have free trade, international wages and social-security rates, you must have a closely knit understanding between nations. To even begin to work toward any or all of these things, you must have a strong, solid foundation for such international co-operation. And it must be democratic. It must be established at the moment these other nations need our help, so that we can be certain that it's democratic.

That simplifies everything enormously. The answer is—yeah, you guessed it—"obvious as all hell!"

Whew! That turned out to be more than I thought it would. Anyway, it proves that your editorial is certainly an excellent starting point for an analysis of the world situation. Now for the rest of the mag.

To be brief, for a change, "Bridle and Saddle" was tops. "A Nose for News" followed second. Sheer readability. So many science-fiction yarns are losing that special quality of working up to a mighty dynamic, yet expected climax, and then popping off with something just as dynamic, but almost wholly unexpected. The article came third. Much more enjoyable than some of the previous ones.—Joe Gibson, 224 North High, Albuquerque, New Mexico.

With De Camp in the navy, we've lost contact with Harold Shea.

Dear Mr. Campbell:

Following the lead of Mr. Jensen, here are some more cracks in favor of the much-abused Doc Smith:

The characterization, say his critics, is not so hot. I beg to differ. Maybe Kinnison *is* getting a little top-heavy—though he is, at that, much more plausible than some of Hamilton's and Binder's heroes, to say nothing of Hawk Carse—but that doesn't mean that the other figures are any worse; in fact, some of them are on a par with Merritt. For example:

Mentor. "Second-stage Lensmen" brings out the precise, methodical—almost Germanic—personality of this ancient Arisian far better than any contemporary attempt at picturing the *really*-advanced race. The last conversation of SSL is almost humorous, in which the Arisian ties down every little particular to fit his idea of the Scheme of Things.

Sir Austin Cardynge, "the lean, gray tomcat." It is hardly necessary to go into further details. Brainstorm: why not make Sir Austin the hero of the next story?

Nadreck of Palain. By far the finest bit of characterization in the story, and one of the finest in the history of science-fiction. This being's apologetic "poor efforts" with their astonishing results will long be remembered.

Worsel. He and Nadreck are alien beings that are really alien, not just humans in dragon's clothing.

Fossten, of course.

Illona Potter, the "squirrel-brained" zwilnik.

Helen of Troy, as unhuman a being as Worsel and Nadreck. Smith has almost outdone even Nadreck—although that's impossible—in depicting the matriarch of Lyrane.

And, of course, the lesser characters: Gudrith Khars with his ignominious handling by Cartiff; Menjo Bleeko; Master Pilot Henry Henderson; the fascinating pseudopersonality of "Cartiff" himself, and a host of others. (There are other major characters, of course, but most of them were most fully described in "Galactic Patrol" or "Gray Lensman" rather than "Second-stage Lensmen.")

Aside from the attacks on characterization, Sam Salant's crack "Smith plots . . . can surpass only those of the opera" merits comment, as this insult may be rather a boomerang. Study over the plot of "Der Ring des Nibelungen!" That's one of the most fascinating tales that has ever been written. In fact, I believe it would make a good story for *Unknown Worlds*. How about it, Mr. Campbell? Is Harold Shea in condition to visit the world of "Die Gotterdamerung," or was Hubbard right about our hero's demise in "The Case of the Friendly Corpse"?—Paul Carter, 156 South University Street, Blackfoot, Idaho.

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IMPEDIMENT

By Hal Clement

● Given telepathy, there would be no great problem in communication between alien peoples. Even so strange a pair as an insectile race and a human could understand each other. So some say—but it might work out like this!

Illustrated by Orban

Boss ducked back from the outer lock as a whir of wings became audible outside. The warning came barely in time; a five-foot silvery body shot through the opening, checked its speed instantly, and settled to the floor of the lock chamber. It was one of the crew, evidently badly winded. His four legs seemed to sag under the weight of the compact body, and his wings drooped almost to the floor. Flight, or any other severe exertion, was a serious undertaking in the gravity of this world; even *accelerine*, which speeded up normal metabolism to compensate for the increased demand, was not perfect.

Boss was not accustomed to getting out of anyone's way, least of all in the case of his own underlings. His temper, normally short enough, came dangerously near the boiling point; the wave of thought that poured from his mind to that of the weary flier was vitriolic.

"All right, make it good. Why do I have to dodge out of the path of every idiotic spacehand who comes tearing back here as though the planet was full of devils? Why? What's the rush, anyway? This is the first time I ever saw you in a hurry, except when I told you to hop!"

"But you told me this time, Boss," was the plaintive answer. "You said that the moment that creature you were after turned into the path leading here, I was to get word to you. It's on the way now."

"That's different. Get out of sight. Tell Second to make sure everybody's in his quarters, and that all the doors along the central hall are locked. Turn out all lights, except for one at each end of the hall. No one is to be visible from that hallway, and no other part of the ship is to be accessible from it. Is that understood?"

"Yes, Boss."

"Clear out, then. That's the way you wanted things, isn't it, Talker?"

The being addressed, who had heard the preceding dialogue with more amusement than respect, was watching from the inner door of the air lock. Like the blustering commander and the obsequious crew member, he supported his body almost horizontally on four slender legs. Another pair of appendages terminated in prehensile organs as efficient as human hands, and a double pair of silvery-gray, membraneous wings were folded along the sides of his streamlined, insectile body.

He could best be described to an Earthman as a giant hawk moth, the resemblance being heightened by the broad, feathery antennae projecting some eighteen inches from a point above his eyes. Those appendages alone differentiated him from the others of his kind; those of the captain and crew were a bare eight inches in length, narrower, and less mobile.

His eyes were the most human characteristics—more accurately, the only ones—that he possessed. Two disks of topaz, more than three inches across, they lent a strangely sagacious expression to the grotesque countenance.

"You have understood well, commander," radiated Talker, "even though you seem unable to realize the necessity for this action. The creature must see enough of the ship to arouse his curiosity; at the same time he must gain no inkling of our presence."

"Why not?" asked Boss. "It seems to me that we could learn to communicate much more quickly if we capture him. You say he must be allowed to come and go as he pleases for many days, and must remain under the impression that this ship is deserted. I know you've been trained to communication all your life, but—"

"But nothing! That one fact should make it evident that I know more than you can hope to understand about the problem we're facing. Come up to the control room—that native will arrive shortly, and that's the only place from which we can watch him without being seen ourselves."

Talker led the way forward along the dimly lit main corridor, into which the inner door of the air lock opened directly. At its end, a low doorway opened, and a spiral ramp led to the control deck, half a level higher. Here the two paused. Metal grillework, its interstices filled with glass, formed the rear wall of the room and afforded a view the whole length of the corridor. Talker extinguished the control-room lights, and settled himself at this vantage point.

His name was no indication of his temperament. The narrator, in fact, must accept full blame for the former. Had it been merely a question of translating from one vocal language to another, it would have been possible to set down a jumble of vowels and consonants, the more unpronounceable the better, and claim that the English alphabet provided no means of coming closer to the true pronunciation. Unfortunately, these beings were able to sense directly the minute electrical disturbances that accompany nerve currents; they conversed by broadcasting reproductions of the appropriate sensory impressions. The "language," if it could be so called, might be thought of as possessing the elements of a vocal tongue—nouns, verbs, and modifiers; interjections were replaced by the appropriate emotions, but most of the conversation was reproduced visual imagery.

Obviously, personal names were nonexistent; but the knowledge of identity was in no way impaired. An individual was thought of with respect to his position, temporary or permanent, in the group, or by his personal characteristics. The names used are attempts to show this fact.

No name would suit the arrogant, peppery commander of the vessel, other than the one we have used; but the cognomen "Talker" merits further explanation.

The rulers of his home planet had many of Boss' characteristics. They were the outcome of ages of government similar to the feudal systems of Earth's Middle Ages. Ranks corresponding to kings, lords, and dukes existed; warfare was almost continuous. Talker belonged to a class having almost exactly the same duties as medieval heralds; he had been trained from infancy in the traditions, obligations, and special abilities of that class. He was one of a clique which, within itself, formed an international fraternity almost as powerful as any of the governments. Their indispensability protected them; they formed, in addition, probably the most intelligent group in the world. The rulers, and through them, the other inhabitants, looked up to them, and perhaps even feared them a little. The enormously developed faculty of communication implied an unparalleled ability to catch and decipher the mental radiations of others; the development of that power was the "herald's" chief exercise. These last facts should suffice to explain the power of the group, as well as the orgin of Talker's name.

Once comfortably settled, Talker again addressed the captain.

"I can't blame you too much for failure to understand the need for this procedure. You lack the training, as you have said; and in addition, there is a condition present whose very possibility never before occurred to me. Tell me, Boss, could you imagine someone—one of your engineers, let us say—acting quite normally, and yet radiating impulses that meant absolutely nothing to you?"

"None of them knows enough to think anything I couldn't understand," was the incredulous answer. "If one of them did, I'd lock him up for examination."

"Exactly. You can't imagine a perfectly sane mind giving off anything but clear thoughts. But what are the thoughts, the waves, that you hear?"

"I hear what he's thinking."

"You don't. Your antennae pick up waves which are generated by the chemical processes going on in his brain. Through long practice, you have learned to interpret those waves in terms of the original thoughts; but what thought actually is, neither you nor I nor anyone else knows. We have 'thought' in the same fashion all our lives; one brain radiates just like another. But this creature, with whom we have to communicate, is a member of another race; the same thoughts in his mind produce different radiations—the very

structure of his brain is, quite likely, different from ours. That was why I was so long finding him; I could not disentangle his radiations from the nerve waves of the other relatively unintelligent life forms around here, until I actually saw him performing actions that proved unquestionably that he does possess a reasoning brain. Even then, it was some time before I realized just what was wrong—it was so new and different."

"Then what can you do? What good will those observations do us!" asked Boss, almost tremulously. "I don't get it entirely, but you seem to. If you can't talk to him, how can we get the stuff we need? And if we don't get it, please tell me how we dare show our faces again within five light-years of home!"

"I am far from sure of just how much can be done," replied the other. "It will be necessary to determine, if possible, the relation between what this creature thinks and what he radiates; I don't think it will be easy. These observations are for the purpose of getting a start in that direction.

"As to the other questions, they are entirely your business. You command this ship; and this is the first time I ever saw you want to talk to someone before you helped yourself to his belongings. If you find yourself unable to do so, we can go back, anyway—if labor is scarce, we might get off with a life sentence in the King's mines on the big moon."

"If they still belong to the King by then. I think I'd rather die here, or in space."

"At least, there would be no trouble in getting hold of arsenic," said Talker dryly. "Those mines produce more of that stuff than anything else. If there is any at all on this planet, we have no time to waste on a probably fruitless search; we must get it from the natives, if they know what it is and have any."

"And to find out if they have any, we must talk to them," answered Boss. "I wish us luck, Talker. Go to it."

The astroplane rested in a small arroyo not much wider than its own hull. The banks of this gully rose nearly to the control-room ports, and from where he lay, Talker could see the gap which marked the point where the trail across the main valley emerged from among the trees. Down that trail the native must come; he had been seen coming through the gap in the hills that bounded the valley on the south side, and no other trail led to the pass in the northern boundary, which was marked by even higher and far steeper cliffs. There seemed little in the valley itself to attract an intelligent being, except animals of various species; and the Talker knew that the camp on the other side of the southern hills was well supplied with food, so that the native would probably not be hunting. Would he be superstitiously afraid of the ship, or intelligently curious enough to examine it more closely?

The question was not long in being answered. Talker sensed the nearness of the creature some time before it became visible; the herald judged, correctly, that it had seen the vessel first and was approaching cautiously, under cover. For several minutes, nothing happened; then the man walked boldly to the edge of the bank and stood there, carefully examining the long metal hull.

Both aliens had seen him before, but only at a considerable distance. Talker's chief surprise at the human form was that a being should support a mass about four times his own, against the relatively enormous gravity of Earth, on but two legs—though the legs, it is true, resembled tree trunks when compared to the stalklike limbs of the visitors.

The man held a rifle in one hand. The watchers recognized it as a weapon of some sort, but were unable to make out its details even in the midmorning sunlight which shone upon the native. They waited, even Boss maintaining an unaccustomed silence, while the newcomer took in the details of the forty-meter, cigar-shaped spaceship. He noticed that there were ports—round windows along the sides; these were covered, except for some near the bow, with metal shutters. The exposed windows contained round panes of glass or quartz; the room or rooms within were dark, however, and he could see nothing through them.

A little more than a quarter of the vessel's length back from the nose, was a larger port, evidently an entrance. It was elliptical, and about five feet high and twice as wide. It was half open, giving a curiously deserted appearance to the ship.

Talker and Boss could see the indecision in the man's attitude, although his thought waves, which the former could perceive clearly, were completely indecipherable. The doubt manifested itself in restless motion; the man paced toward the stern of the ship, passing out of the watchers' sight, and reappeared a few minutes later on the opposite bank of the gully. He crossed once more, under the curve of the ship's nose, but this time did not climb the bank. Instead, he disappeared sternward again, evidently having made up his mind.

Talker was sure he knew the decision that had been reached; for a moment he was jubilant, but an instant later he came as close to cursing himself as anyone can without benefit of language. The being quite evidently could not fly; the port was ten feet above its head and fifteen feet from the bank. Even if the man wished to, how could he enter?

Climbing, for obvious reasons, did not occur to Talker; he had

never in his life had to climb, except in buildings too cramped for flying. He caught a glimpse of the man disappearing among the trees, and toyed with the idea of moving to some other part of the planet and trying again.

He did not crystallize this thought sufficiently to mention it to Boss; before he could do so, his attention was caught by something in motion. The man slowly reappeared, dragging a hardwood sapling pole nearly twenty feet in length. He tossed this down the bank, and scrambled after it; then he picked up one end and dragged the pole out of sight along the hull.

Talker realized the plan, and gained new respect for the strength, to him almost inconceivable, that lay in those blocky arms and legs. He heard and correctly interpreted the scraping sound as the pole was laid against the lower sill of the air lock; and moments later, an indicator on the control panel showed that the outer door had been swung a little wider; to admit a pair of human shoulders.

Both aliens glued their eyes to the grillework, looking down the dimly lighted length of corridor to the place where the inner lock door swung wide open, partly blocking further vision. The hinge was to the rear, fortunately; the man would not be hidden from them by the door, if and when he stepped into the hallway.

Boss grew impatient as moments slipped uneventfully by; once he shifted his position, only to freeze motionless again at a warning flicker of radiation from Talker. He thought the latter had seen something, but another minute rolled by before the shadow dimming the light that came through the lock moved enough to show that the man had really entered.

An instant later he had stepped into view. He moved soundlessly, and carried his weapon in a manner that showed it was certainly something more than a club. He was evidently ill at ease; his cramped position accounted largely for that fact—the ceiling of the corridor was barely five feet above the floor. The owners of the ship, with their nearly horizontal carriage, needed little head room.

The man's first action was to peer behind the inner door, rifle held ready. He saw at once that, except for himself, the corridor was empty; but numerous low doors were visible along its full length, with larger portals at each end, and one directly opposite him. The one by which he had entered was the only one open; that immediately facing led, he judged, to a similar air lock on the port side of the ship.

For a minute or two he listened. Then he partly closed the inner door of the lock, so as to allow an unimpeded view the full length of the hall, and walked cautiously forward. Once he raised his hand as though to pound on one of the doors, but evidently thought better of it. Two or three times he looked quickly behind him, turning his head to do so, much to Boss' astonishment. Talker had already deduced from the location of the eyes that the head must be mobile.

The light, set in the ceiling near the front end of the hall, was made the subject of a careful examination. The man looked back along the corridor, noting the row of similar, unlighted bulbs at equal intervals along the ceiling, and the single other lighted one at the far end. Talker was unable to tell from his attitude whether they were something utterly new or completely familiar to him.

Caution had by now succumbed entirely to curiosity. Several doors, including that which led to the control room, were tried. In accordance with Boss' orders, all were locked. For a few moments the man's face stared through the grillework not two feet from his observers; but the control room was in complete darkness, Talker having closed the shutters the instant he was sure the man had entered the lock. The reflection of the ceiling lamp from the glass filling helped to conceal them from the tiny human eyes, and the man turned away without realizing the nearness of the two.

He wandered down to the far end of the hallway, trying a door here and there. None yielded to his efforts, and eventually he swung open the air-lock door and passed out. Talker hastily opened the control-room shutters, in case the being had noticed their previous condition, and saw him disappear in the direction from which he had come. Evidently whatever plans he had formed for the day had been given up.

"Did you get anything?" asked Boss eagerly, as the tension relaxed. He watched impatiently as Talker walked to the control desk, opened a drawer, and helped himself to a tablet of accelerine before answering.

"As much as I expected," he replied finally. "I was able to isolate the radiations of his optical section, when he first looked at the single light at this end—that was why I arranged it that way. Concentrating on those emanations, I think I know the patterns corresponding to some of the more simple combinations of straight lines and circles—the impressions he got while examining the corridor and doors. It is still difficult, because he is highly intelligent and continuously radiates an extremely complex and continually changing pattern which must represent not only the integration of his various sensory impressions, but the thought symbols of abstract ideas; I don't see how I can master those. I think all we can hope to do is to learn his visual pattern, and try to broadcast to him pictures

that will explain what we want. That will take long enough, I fear."

"It better not take too long," remarked Boss. "We can breathe the air and eat the food of this planet, tough as the latter is. But we will live under this gravity just as long as the accelerine holds out, which won't be too many weeks.

"You can synthesize accelerine out of those plants with the straight needlelike leaves," answered Talker. "Doc told me this morning; that was some of his product that I just ate. Accelerine won't be enough, however. It speeds up our metabolism, makes us eat like power furnaces, and gives us enough muscular strength to stand up and walk, or even fly; but if we keep taking it too long, it's an even bet whether we die young of old age, or get so accustomed to it that it becomes useless. Also, it's dangerous in another way—you were telling me that two of the fighters have broken legs, from landing too hard or trying to stand up too quickly. Our muscles can stand the gravity, helped by the dope, but our skeletons can't."

"Can't you ever deliver a little good news, without mixing it so thoroughly with bad that I feel worse than ever?" asked Boss. He stalked aft to the engine room, and relieved his feelings by promising a couple of unfortunate workers the dirty job of replacing the main attractor bar in the power converter, the next time the flood of incoming radiation from space riddled it into uselessness.

Talker squatter where he was, and thought. Learning a language was a new form of exercise to one who had never before dreamed of its necessity. He guessed, from the attitude of the native as he departed, that it would be necessary to reveal the presence of the aliens aboard if the man's interest in the ship was to be maintained. Thinking the matter over, it suddenly occurred to Talker that the man himself must have some means of communicating with his kind; and there had been no antennae visible. If the method were different from that employed by Talker's people, it might be more suited to present requirements. Yes, revealing their presence was definitely indicated, the more so since, finding himself unable to solve the ship's mystery alone, the man might go off to obtain others of his kind. It was no part of Boss' plan to reveal his presence to the main population of the planet in his present nearly defenseless condition.

It would be easy enough to induce the man to return. One of the crew, flying toward the ship, could "accidentally" pass over his camp. Whether, on finding the vessel inhabited, he would be bold enough to venture near any of the aliens, was a matter that could be tested only by experiment; Talker believed he would, since he had shown sufficient courage to enter the ship in ignorance of what lay within.

The herald crept to the controls, and pressed the signal switch indicating that the commander's presence was desired in the control room. Perhaps a minute later, Boss struggled up the spiral, air hissing from his breathing vents as his lungs tried to cope with the results of his haste. If he had had to rely on vocal speech, he probably couldn't have spoken at all.

"Careful," warned Talker; "remember those broken legs among the crew."

"What is it now?" asked the captain. "Come to think of it, why do I always have to come to you? I'm in command here."

Talker did not bother to dispute the statement. The feeling of superiority ingrained in every member of his class was, through motives of prudence, kept very much under cover. He informed the captain of the results of his cogitation, and let him give the necessary orders—orders which had to be relayed through Talker, in any case.

There were no communicating devices on the ship; the herald had to radiate all of Boss' commands to the proper individuals. There was no machine known to these beings which was capable of receiving, analyzing and transmitting through wires or by wave the delicate impulses radiated by their minds. They had the signal system already referred to, which was limited to a few standard commands; but in general, messages to be transmitted more than a few yards, or through the interference of metal walls, had to pass through the antennae of a herald. It is conceivable that the heralds themselves had subtly

discouraged, for their own ends, research in mechanical communication.

One of the fighters was ordered to the air lock. Talker and Boss met him there, and the former carefully explained the purpose of the flight. The soldier signified his understanding, made sure that his tiny case of accelerine tablets was securely fastened to his leg, and launched himself from the sill. He rose almost vertically, and disappeared over the trees. Talker, after a moment's thought, rose also, and settled on the bank opposite the air-lock door. Boss started to follow, but the other "advised" him not to.

"Stay in the doorway," said Talker, "but be sure you are in plain sight. I want him to concentrate his attention on me, but I don't want to give him the impression that you are trying to hide. He might misinterpret the action. When he gets here, keep quiet. I'll have other things to do than listen to you."

The wait, which Talker had expected to be a few minutes, grew into half an hour, without any sign from the decoy. Boss, true to his nature, fumed and fidgeted, providing his companion with a good deal of—well-concealed—amusement. His temper did not improve when the fighter, appearing with a rush of wings, settled in front of Talker, instead of the commander, to make his report.

"He was still in the woods when I went out, sir," said the flier. "I found a spot where I could watch an open place on the trail. I was sure he hadn't come by yet, so I landed on a ridge—the place was near the cliffs—and waited. When he appeared at the edge of the clearing, I flew low; out of sight from the ground, to the other side of the hills; then I came back, quite high, toward here. I'm sure he saw me; I passed directly over him, and he stopped in the middle of the clearing with his whole head tipped up—I suppose he had to, in order to look up with those sunken-in little eyes."

"You have done well. Did you see the creature turn, as though to come back this way?"

"He turned to watch me as I passed overhead; he was still standing motionless the last I saw of him. I don't know what he was going to do. So far as I can tell, he doesn't think at all."

"All right. You may return to your quarters, and eat if you wish. Tell the rest of the crew they are free to move about in the ship, but the ports must be left closed—no one but Boss and me must be visible from the outside."

The soldier vanished into the vessel, showing his near exhaustion in the clumsiness of his movements. Boss looked after him.

"We can't get away from this place too soon to suit me," he commented finally. "A few more weeks and I won't have a single soldier or engineer fit for action. Why did you pick this ghastly planet as a place to restock, anyway? There are eight others in this system."

"Yes," replied Talker sarcastically, "eight others. One so far from the Sun we'd never have noticed it, if our course hadn't taken us within half a million miles; four almost as cold, the smallest of them four times the size of this world; two with decent gravity, but without air enough to activate a lump of phosphorus—one of them near the Sun and continually facing it with one hemisphere; and one like this one, with air that would have mummified you at the first attempt to breathe. If you want to go to one of the others, all right—maybe it would be a better way to die, at that."

"All right, forget it—I was just wondering," answered Boss. "I'm so full of this blasted dope we have to take that I can't think straight, anyway. But when is that native coming back?"

"I'm not sure he is, just yet. The soldier flew so as to make it appear that he was coming from the other side of the hills; possibly the creature went to make sure his camp had not been molested. In that case, he may not return today; it's quite a trip for a ground animal, you know."

"Then what are we waiting here for? If he is very long coming, you won't be able to stay awake to meet him. You should have told the soldier to stay out until he was sure what the creature was going to do."

"That would probably have cost us the soldier. You saw the condition he was in when he came back. If you feel energetic, you can send out watchers in relays; but on a day like this, I don't see how they can keep out of sight—there's not a cloud in the sky. I was planning to allow a reasonable time for the native to come back from the point where he saw our soldier. If he doesn't show up, I'll get a night's sleep and expect him tomorrow morning."

"How do you know how long he'll take? You don't know the turns and twists in the trail, and you don't know how fast he walks when he's going somewhere."

"I know how long it took him to come from the pass this morning," answered Talker. "He was near there when the soldier saw him."

"Well, it's your idea, but I don't mind waiting. This sunlight is comfortable." Boss swung the air-lock door wide open, letting the sun shine some distance into the lock chamber, and settled himself on the smooth metal floor. Any long period of inactivity had one inevitable result; for it was necessary to sleep some sixteen hours out of twenty-four to offset the enormous consumption of energy exacted by Earth's gravity. Boss may have intended to watch, but he was asleep in two minutes.

Talker remained awake longer. He had indulged in less physical activity than anyone else on the ship, and his mind was normally by far the most active. He squatted on the soft carpet of grass, legs spread spiderwise on either side of his body, while the great topaz eyes took in the details of the surroundings.

Numerous living creatures were visible or audible. Birds were everywhere, as were the insects upon which many of them fed; for in August even Alaska knows that summer has been present for quite a while. The insects, naturally, interested Talker. Some of them bore rather close resemblance to himself, except in the matter of size. A few butterflies fluttered near him in erratic circles; he radiated a thought to them, but got no answer. He had expected none; but he continued to think to them, as a man thinks aloud to a dog, until their intoxicated flight carried them away from the neighborhood.

The flowers, too, caught his eye. They were "not much," as a human florist might have told him, but all were strange to Talker—his home planet had flowers, but they grew in the wilder regions, where it was decidedly unsafe to venture at any time. The only plants allowed in the vicinity of the castlelike fortresses, in which all civilized beings dwelt, were those which were of use in sustaining life. The few vegetables of this variety which bore attractive blooms were too common to be appreciated.

Talker himself was half asleep when he became aware of the man's approach. Had the alien known more of Earthly conditions, he would have realized, from the fact that man was audible at all at fifty yards, that he was a city dweller.

Talker folded his wings tight against his streamlined body and watched the opening of the trail. The native was even more cautious in his approach than he had been the first time; but in spite of this, the two saw each other almost simultaneously. The man had stepped from the forest with his eyes fixed on Boss, asleep in the air lock, and did not see Talker until the shelter of the trees was behind him.

He stopped instantly, rifle halfway to his shoulder; but Talker carefully refrained from moving anything but his eyes until the weapon was lowered again. To his surprise, the gun was not merely lowered, but slung across the man's back; the man himself took a step or two forward, and stopped about fifteen feet away from the alien.

Talker was wondering just how far he could go without alarming the other into flight. Allen Kirk was wondering exactly the same thing. The human being was on the less comfortable side of the exchange, for he was seeing for the first time a creature who had obviously not originated upon his own planet. He felt uncomfortable, under the unwinking stare of two pairs of eyes—the optical organs of Talker's kind are lidless, and Kirk had no means of knowing that Boss was asleep—and the uncanny stillness of the two strange beings got on his nerves. In spite of this, Talker was the first to break down the tension.

His antennae had been folded back, unnoticeable against the silver-gray fur of his body. Now they swung forward, expanding into two iridescent plumes as their owner sought to interpret the mental radiations from the human brain.

Kirk was at first startled, then interested. He knew that the antennae of terrestrial moths were strongly suspected of acting as organs of communication, in some cases at least. It was possible, then, that this mothlike entity was interested solely in conversing with him—a possibility made more probable by the fact that neither creature had as yet made a hostile move, so far as the Earthling could tell.

Talker was fortunate in encountering Kirk, instead of a member of one of the several small tribes dwelling in the surrounding territory. Kirk was educated—he had just completed his third year of university study, and was working during the summer recess at plotting the activities of a minor insect pest which was threatening to spread south and west into Canada. He had majored in sociology, and had taken courses in biology, astronomy and psychology—though the last subject had bored him excessively.

He had realized from the first, of course, that the object in the gully was a flying machine of some sort; nothing else could have reached this spot without leaving traces in the surrounding forest. He had noticed the air-tight construction of the doorway, but subconsciously refused to consider its full implication until he was actually confronted by one of the vessel's owners, and realized that neither ship nor navigators could possibly have originated on Earth.

With the realization that the being before him wanted to communicate, Kirk bent his thoughts in that direction. He regretted the nearly wasted psychology course; it was practically certain that none of the languages he knew would be of use. Nevertheless, he uttered a few words, to see if they produced any effect; for all he knew, the alien might not be able to hear.

Talker did hear, and showed the fact by a slight start; but the auditory impression he received was unimportant. As he had mentioned to Boss, he had managed to disentagle the cerebral radiations corresponding to a few simple line patterns, as received by the human eyes and symbolized in the brain; and he received, coincidentally with the vocal sounds, a thought-wave which he could translate easily

into a series of just such patterns. Kirk, like many people, involuntarily visualized the written form of the words he uttered—not perfectly, but in sufficient detail for the keen mind of the listener to decipher.

Kirk saw the start, though he misinterpreted it. The motion that caught his attention was the sudden stiffening of the antennae as he spoke, the two plumelike organs expanding sideways and pointing diagonally forward, as though to bring his head between their tips. For almost a minute the two creatures remained absolutely motionless, Talker hoping for and expecting further speech, and Allen Kirk watching for some understandable signal. Then the antennae relaxed, and Talker considered the possible meaning of the images he had received.

His own race had a written language—or rather, a means for permanently recording events and ideas; since they had no vocal speech, their "writing" must have been utterly different in basis from that of any Earthly people, for the vast majority of terrestrial written languages are basically phonetic. At any rate, it is certain that Talker had severe difficulty in connecting with any, to him, normal means of communication the symbols he learned from Kirk; for a time, at least; he did not realize that they were arbitrary line arrangements.

Kirk watched the nearly motionless insect for several minutes, without any idea of the true nature of the difficulty. Then, since speech had produced some effect the first time, he tried it again. The result caused him to doubt his own sanity.

Talker knew that he needed further data; in an attempt to obtain it, he simply reached forward to a bare spot of earth and scratched with his odd "hand" the line pattern he had last seen in the human mind. Like Kirk's speaking, it was purely an experiment.

To the man, it was a miracle. He spoke; and the grotesque thing before him wrote—crudely and clumsily, to be sure, for Talker's interpretation was still imperfect, and he was, to put it mildly, unpracticed in the art of penmanship—the last few words that the man had uttered. Kirk was momentarily dumfounded, unable for an instant to think coherently; then he jumped to a natural, but erroneous, conclusion. The stranger, he decided, must lack vocal cords, but had learned written English from someone else. That implied previous friendly relationships with a human being, and for the first time Kirk felt fully at ease in the presence of the strange creatures.

He drew his knife, and with the tip scratched, "Who are you?" on the ground beside Talker's line. The meaning of the question lay in his mind; but it was couched in terms far too abstract for Talker to connect directly with the marks. A problem roughly similar would be faced by a three-year-old child, not yet literate, presented with a brick covered with cuneiform writing and told that it meant something. Talker saw the same letters in the man's brain, but they were as utterly meaningless there as on the ground. The conference seemed to have reached an impasse.

In spite of his relatively deep-set eyes, which should, in Talker's opinion, have limited his range of vision to what lay before him, Kirk was the first to see Boss move. He turned his head to see more clearly, and Talker followed his gaze with one eye. Boss had awakened, and was standing as high as his legs would lift him in an effort to see the marks on the ground—the top of the bank was about on the same level as the air-lock floor. He saw the attention of the other two directed his way, and spoke to Talker.

"What is that? Have you got in touch with him? I can't see what you have on the ground there."

Talker turned his antennae toward the air lock, not that it was necessary, but to assure the human being that Boss was being included in the conversation. "Come on over," he said resignedly, "though it won't do you much good to see. Don't fly too close to the native, and don't get nearer to him than I do at any time."

Kirk watched Boss spread his wings and launch himself toward Talker. The pinions moved too fast to be visible; it occurred to Kirk that these creatures were heavier than any Earthly bird, except for flightless forms like the ostrich, yet their wings spanned less than eight feet.

Boss took a single glance at the letters on the ground, and turned his attention to the Earthman. This was the first time he had seen him in full daylight, and he made the most of the opportunity, mercifully remaining silent the while. Talker promptly forgot him, as nearly as such an individual can be forgotten, and brought himself back to the matter in hand.

The "natural" method of learning a language consists of pointing out objects and having their names repeated until one can remember them. This is the first method that suggests itself to a human being, if no printed grammar is available. Talker hit upon it only after long and profound cogitation, when he suddenly realized that he had learned to interpret the human visual impressions in just that fashion—placing the subject in contact with simple objects, and examining the resulting mental radiations. He tried it.

Normally, the teacher of a language, whatever method he uses, knows what is being done. Kirk did not, for some time. Talker pointed at the ship with one of his hands, watching the man's mind intently for a series of marks such as had accom-

panied the sounds from his mouth. Kirk looked in the indicated direction, and then back at Talker. The latter pointed again; and a distinct picture, such as he had been seeking, appeared for an instant in the man's mind, to be replaced almost at once by an indecipherable complex of abstract thoughts.

Talker scratched the first impression on the ground—a perfectly recognizable word, "Ship," and looked up again. The man had disappeared. For an instant Talker was confused; then he heard various sounds from the gully, and crawled to the edge to look over. Kirk was below, raising his pole, which had been lying where he had left it, to the sill of the air lock. Still believing that Talker was able to write English, he had completely misinterpreted the gestures and writing, and supposed he was being requested to enter the craft.

Talker had a feeling of helplessness, in the face of his troubles; then he pulled himself together, forcing himself to remember that his life, and the other lives on the ship, depended on his efforts. At least, he now knew that the marks had a definite meaning, and he had learned the symbol for "ship." It was, he tried to convince himself, a fair beginning.

The man was crouching in the lock entrance—it was not high enough for him to stand—watching expectantly. Talker beckoned him back. If the man misunderstood his first attempt, now was the time to straighten it out. Kirk looked annoyed, though the aliens could not interpret the expression, slid down the pole, and scrambled back up the bank.

Talker tried again, pointing this time to the early afternoon sun, and writing the word when it formed in Kirk's mind. The Earthman looked down at the result.

"If that job were necessary, it would be hopeless, friend," he said, "but it isn't necessary. I can speak English, and read it, and write it, thank you. If you can't talk, why don't you just write out what you want me to know?"

Not a word of this was understandable to Talker; in a rather hopeless fashion, he wrote the word or two which had been pictured clearly enough for him to catch, and succeeded in exasperating Kirk still further.

The man certainly cannot be accused of stupidity; it was not his fault that he failed to experience a flash of insight that would give the clue to the alien's meaning. The great majority of people would have done no better, except, perhaps, for some lucky chance. Human experience of thought transference is limited to the claims of "psychics" and to fantastic literature, except for a few scientific experiments of doubtful value; Kirk was not addicted to the reading of any of these products of mental aberration, and made no claim to be any sort of scientist. He had begun by jumping to a conclusion, and for some time it simply did not occur to him that the conclusion might be erroneous—the evidence had been quite convincing, to him, that Talker was acquainted with the English language. It followed that the mothlike one's intentions, motivating all this gesticulation and writing, were to teach Kirk the same tongue: an idea so exactly opposite the true state of affairs as to be almost comical.

Twice more Talker repeated his forlorn attempt to get his idea across to the other; twice Kirk repeated his expostulation, once going so far as to write it out on the ground, when it occurred to him that Talker might be deaf. The third time, the Earthling's temper broke free of its moorings—almost. He was not accustomed to using profanity; his family, whose elder members had carefully controlled his upbringing, was almost Puritanical in that respect, and habit got control of his reactions in time to prevent his speaking aloud the words in his mind. His reaction may be imagined when, without Kirk's having uttered a sound, except for a strangled snort, Talker extended a forelimb and scratched a perfectly legible "Damn" on the bare patch of ground.

The word "insight" provides a psychologist with material for hours of talk. Its precise meaning cannot be given without tacit assumption of understanding of its nature; neither Kirk nor the narrator possesses that understanding. It is assumed that the readers have had experience of insight, and can understand the habit of cartoonists of symbolizing its presence by an incandescent bulb—whether this habit antedates or succeeds the coining of the phrase "to see light" is a purely academic question. All that matters to us is the fact that Kirk abruptly saw the light—dimly at first, and then, though it strained his credulity to the breaking point, with something like comprehension. Why that particular incident should have served to unlock the door we cannot say: certainly Talker's knowledge of a bit of English profanity could have had many other explanations. Insight, as we have intimated, is a rather obscure process.

For almost a full minute, Earthling and alien stared at each other, the former struggling with his own prejudices and the latter wondering what had happened—even he, unused to interpreting human attitudes, could perceive that Kirk was disturbed. Then the Earthman, with the seeds of truth rapidly maturing in his mind, deliberately visualized a simple design—a circle inscribed in a square. Talker promptly and accurately reproduced it on his improvised blackboard. Kirk tried various letters of the English and Greek alphabets, and finally satisfied

himself that Talker was actually obtaining the impressions directly from the thoughts. Talker, for his part, discovered that the visual impressions were almost as clear to him now as those of Boss, who had lost his patience and temper long before the Earthman, and had withdrawn by request. He was now sulking, once more squatting in the air lock.

The auditory impressions and abstract thoughts were still a hopeless confusion, so far as Talker was concerned; he never did make a serious attempt to unravel them. Both he and Kirk were satisfied to have found a common ground for expression, and completely ignored lesser matters. Kirk seated himself on the ground beside Talker, and an intensive course in English was rapidly embarked upon.

Not until the Sun was low did Kirk abandon the task, and then it was only because of hunger. Talker had already learned enough to understand the man's declaration that he would return in the morning; and Kirk went back to his camp in the gathering dusk, to prepare a meal and obtain a few hours' sleep—very few, as may well be imagined. He spent a good deal of the night awake in his blankets, staring up at the clear sky and wondering, at times aloud, from which of the thousands of points of light his new acquaintance had come. He was sufficiently adventurous by nature not to ask himself why they had come.

Talker watched the man disappear into the woods, and turned wearily toward the ship. He was overtired; the effects of the earlier dose of accelerine were beginning to abate, and he had a well-founded objection to taking more of the stuff than was necessary to keep him alive. With an effort, he flew the few yards between the bank and the air lock, settling heavily beside Boss. The sound of his wings woke the commander, who eagerly demanded a report on progress in communication. Talker obliged, somewhat shortly; his fatigue had brought him unusually close to anger.

"I have made a beginning, in spite of your aid. How long it will take to set up working communication, I don't know; but I will try to direct the conversations so that the ideas we need to impart are used. He will be back when the Sun rises again; in the meantime, I need sleep. Don't disturb me until the native returns."

Boss was too elated at Talker's news to take offense at his manner. He allowed the herald to depart to his own quarters, and went off himself to spread the news, after closing the outer air-lock door. The second in command received the information with glee, and in short order the crew was in better spirits than it had enjoyed since landing on this unhealthy and uncomfortable planet. Even the inhabitants of the sick bay, now three in number since the decoy who had gone after Kirk had returned with a complete set of pulled wing ligaments, began to feel that they were suffering in a good cause, and ceased thinking uncomplimentary thoughts about their officers. The doctor, too, usually by far the most pessimistic member of the ship's personnel, ceased making pointed remarks about "wasted effort" as he worked over his patients. Not one of them appreciated the very real difficulties that still lay ahead, before Talker would have any chance of making the human being understand their needs. None thought that anything more than the transmission of that knowledge would be necessary; and all, except Talker, regarded that matter as practically solved.

The herald had a better appreciation of what lay before him, and was far from sure of his course of action. He had promised Boss to arrange matters so that their needs would be among the first things to be transmitted to the Earthling; but he could not see how he was to fulfill the promise. Had it been merely a matter of keeping his word to the commander, Talker would not have been bothered in the least; he considered anything said to Boss was justified if it succeeded in silencing him. Unfortunately, Talker's own future existence depended on his ability to carry out the terms of that promise. Even with his lack of experience in learning, or teaching, languages, it occurred to him that making advanced chemistry the subject of the lessons was bound to be rather awkward. One cannot point out atoms and molecules individually; it would be pure chance if the man recognized either diagrams or samples, since the latter would be of value only to a chemist with a laboratory, and the former might not—probably would not—con-

form to human theories of atomic formation. It did not occur to Talker that the ship's pharmacist might be of help; he had been out of contact with his own class for so long that an unfortunate, but almost inevitable, sense of his own superiority had grown up within him. The rest of the crew, to him, were mere laborers; he had never talked with any of them as friend to friend; he had solved all his own problems since joining the crew, and would undoubtedly continue to do so unless and until something drastic forced him out of his rut. But it said for him that he was not conceited in the ordinary sense of the word; the feeling of superiority was the result of class training; and the ignoring of others' abilities was completely unconscious.

At the moment, Talker was not worrying about his course of action. He was sound asleep, crouched on the padding of the floor of his quarters. Boss, having made sure that his own contributions toward the present state of near-success were not being minimized in the rapidly spreading news, also retired. The second officer made sure that both air locks were fast, and made his way to the long wardroom in the lower part of the ship. Most of the soldiers and several engineers were gathered there, discussing the day's events and the chances of reaching their original planetary system—they no longer had "homes" since Boss had broken allegiance with his overlord. The officer's presence did not interrupt the conversation; the Second was a member of the soldier class, and entered the discussion on an equal plane with the others.

It is exceedingly doubtful if any of the crew had ever objected to Boss' dereliction; the act had made little or no change in the course of their existence, and they cared little for whom they worked and fought. If anything, they preferred the new state of affairs, for the constant internecine warfare between the rulers of their home world resembled organized piracy more than anything else, and there was now no need to turn over most of the loot to their own overlord. Boss, of course, had acted almost on impulse, giving little or no thought to such matters as the problem of replenishing exhausted food and ammunition—he expected to supply those wants from his victims. Unfortunately, an unexpected encounter with a full-armed ship belonging to his erstwhile ruler had left him in no condition to fight anybody; after three or four attempts to bluff supplies from isolated stations in his own system, he had made matters a little too hot for himself and fled in the handiest direction, which happened to be straight away from the four pursuing warships. Near the speed of light, his vessel became indetectable; and once out of his own system, he had not dared to stop until Sol was bright on his navigation plates. His reasons for landing on Earth have already been made clear. He had food in plenty, and his ship drew its power from stellar radiations; but not a locker on his ship contained a round of ammunition.

If the discomfort of their environment had turned any of Boss' crew against him, Talker's recent efforts had brought them back. The second officer found himself in complete agreement with the crew—it was good to have a commander like Boss, to keep things under control! There passed a peaceful and happy evening on Boss' vessel.

Boss had found it almost impossible to set regular watches. No matter how often he relieved his men, the inactivity of the job promptly put the relief to sleep. The bodies of the crew, exhausted by the constant battle against Earth's savage gravity, would give up and drop the individuals into a coma before they realized that the stimulant accelerine had worn off. The sleep was short, but apparently unavoidable; Talker, alone, had been able to force himself to more or less regular waking and sleeping hours, simply because he did practically no manual labor. For this reason, as soon as he was convinced that there was nothing in the neighborhood that constituted a menace to the ship itself, Boss ceased setting watches and merely closed the ports at night. There were enough differences in physique among the crew members to make it practically certain that someone would always be awake, day or night. The whole thing was horribly unmilitary by any standards, but it was typical of Boss' line-of-least-resistance nature.

It chanced that Boss himself was asleep when Kirk showed up the next morning, and the ports were still sealed. The man threw a stone at the air-lock door, and examined the ship more closely while he waited for something to happen. The Sun had just cleared the trees and was shining directly on the bow of the vessel. This time, Kirk found that he could see a little through the control-room ports—a few glimpses of boards, covered with dials and levers, the latter oddly shaped to conform to the peculiar "hands" of the operators. He was not close enough to the ship to obtain a very wide vision angle through the ports, and he had to move around to see the various parts of the chamber. While he was thus improving his knowledge, his eye caught a flash of reflected sunlight from the beveled edge of the air-lock door, and he turned to see who or what was emerging.

The sound of the stone Kirk had thrown had echoed through the main corridor and reached the "ears" of a party of engineers in the wardroom below. These individuals had interrupted a form of amusement startlingly similar to contract bridge, in

which they were engaged, and one had gone to inform Boss. The latter cursed him, told him to rouse Talker, and went back to sleep.

It was Talker, therefore, followed by some of the more curious engineers, who emerged from the lock. Kirk was able to recognize the herald by his antennae, but could discern no difference between the other members of the group. The meeting adjourned, at Talker's direction, to a spot in the gully, in front of the ship, which bore a large and exceptionally smooth area of sun-dried clay, and lessons began. Talker had brought the appropriate materials with him, and had planned to take notes in his own form of "writing"; but he delegated this task to a member of the audience, and gave his full attention to the delicate matter of guiding the choice of words in the proper direction.

This task was no sinecure, since Talker was still extremely uncertain as to the precise nature of words. The meaning covered by a single word in English sometimes requires several in another language; the reverse is also true. Talker had learned the symbol that indicated the ship; he discovered later, to his confusion, that there exist such things as synonyms, other words that meant the same thing. He never did discover the variety of objects that could have been meant by "ship." Kirk saw these sources of difficulty almost from the beginning, and went to considerable trouble to avoid them.

Each written word, to Talker, was a complete unit; it is doubtful if he ever discovered that they were made of twenty-six simple marks, in various combinations. Obviously this fact complicated his task enormously, but there was nothing to be done about it. To explain the individual letters would have been tantamount to teaching the verbal language; and months, or even years, would have been necessary to teach Talker's auditory organs to recognize the innumeral fine distinctions of pitch and overtone to be found in a single sentence.

The details of the weeks that were taken up in the learning would be of interest to psychologists and semanticists, but would extend the present narrative to an unjustifiable length. There were several short interruptions when Kirk had to forage for food, and once he was forced to absent himself for nearly a week, in order to turn in his parasite report at the nearest center of civilization. He told no one of his find in the forest, and returned thereto as quickly as he could. He found the aliens impatiently waiting for him, and the herald at once returned to the task. Kirk had long since perceived that some tremendous anxiety was behind Talker's insistence, but no amount of effort served to make clear any details.

September and Kirk's patience were drawing to an end by the time that exchange of ideas had progressed to a point where it could be called conversation. Talker wrote with considerable facility, using a pencil and pages from Kirk's notebooks; the man spoke aloud, since he had discovered that this apparently resulted in a sharper mental image of the words. To him, the herald's need was less urgent than the satisfaction of his own curiosity; he asked, so far as Talker's rapidly increasing vocabulary would permit, questions designed to fill that want. He learned something of the physical and sociological nature of the alien's home world—not too much, for Talker had other ideas than the telling of his life story, and Boss became suspicious and almost aggressive when informed of the nature of the Earthman's curiosity. He could conceive of only one use to which such information could possibly be turned.

Kirk finally accepted the inevitable, and permitted Talker to run the conversation in his own fashion, hoping to get a few words of his own into the discussion when the herald's "urgent business" was completed. Talker had kept the man ignorant of Boss' attitude, justly fearing detrimental effects on Kirk's willingness to co-operate.

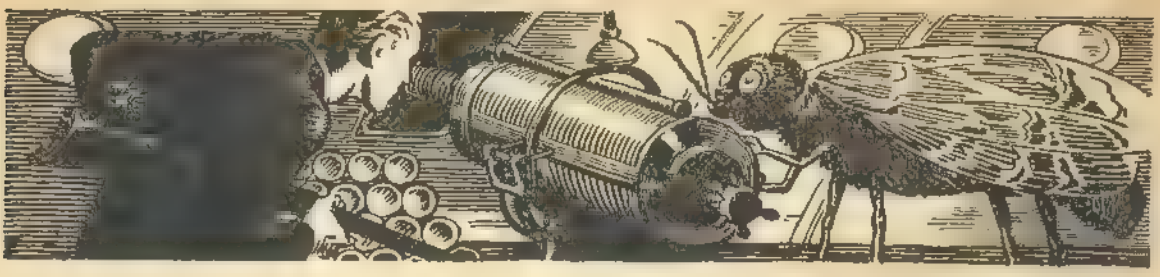
The attempts at explanation, however, seemed as futile as the first words had been. Talker's premonition of the futility of drawings and diagrams was amply justified; not only were the conventions used in drawing by the engineers of his people utterly different from those of Earth, but it is far from certain that the atoms and molecules the aliens tried to draw were the same objects that a terrestrial chemist would have envisioned. It must be remembered that the "atoms" of physics and of chemistry, used by members of the same race, differ to an embarrassing extent; those conceived in the minds of Talker's people would have been simply unrecognizable, even had Kirk possessed any knowledge of chemistry.

The supply of the requisite arsenic was completely exhausted, so that no samples were available; in any case, Kirk's lack of chemical knowledge would undoubtedly have rendered them valueless.

"There is no use in trying to make your needs known in this manner," the human being finally stated. "The only way in which I am at all likely to hit upon the proper word is for you to describe the more common characteristics of the substance, and the uses to which you put it. Your pictures convey no meaning."

"But what characteristics are you likely to recognize?" asked Talker, on the paper. "My engineers have been striving to do that very thing, since we started."

"They have sought to describe its chemical nature," responded



Kirk. "That means nothing to me in any case, for I am not a chemist. What I must know are things like the appearance of the stuff, the appearance of the things that can be made from it, and the reasons you need it so badly. You have not told me enough about yourselves; if I met a party of my own kind stranded on an uninhabited land, I would naturally know many of the things of which they might stand in need, but there is no such guide for me in this case. Tell me why you are here, on a world for which you are so obviously unfitted; tell me why you left your own world, and why you cannot leave this one. Such things will guide me, as could nothing else you might do."

"You are probably right, man. My captain forbade me to divulge such knowledge to you, but I see no other way to make clear our need."

"Why should the commander forbid my learning of you?" asked Kirk. "I see no harm which could result; and I have certainly been frank enough with you and your people. Mothman, I have considered you as being friendly, without seeking evidence of the fact; but I think it would be well for you to tell me much about yourselves, and tell it quickly, before any more efforts are made to supply your wants."

Kirk's voice had suddenly grown hard and toneless, though the aliens could neither appreciate nor interpret the fact. It had come as an abrupt shock to the man, the idea that the helpless-seeming creatures before him could have any motive that might augur ill to humanity, and with it came a realization of the delicacy and importance of his own position. Were these beings using him as a tool, to obtain knowledge of humanity's weaknesses, and to supply themselves with means to assault the race? Unbelievable as it may seem, the thought of such a possibility had not entered his head until that moment; and with its entrance, a new man looked forth at the aliens from Kirk's eyes—a man in whom the last trace of credulity had suddenly vanished, who had lost the simple curiosity that motivated the student of a few minutes before, a man possessed and driven by a suspicion of something which he himself could not fully imagine. The doubts that had failed to appear until now were making up for lost time, and were reinforced by the uncomfortable emotion that accompanies the realization that, through no act or idea of one's own, one has barely been diverted from the commission of a fatal blunder.

Talker realized his own error before the Earthman had finished speaking, and wasted no time in endeavoring to repair it. His ignorance of human psychology was an almost insuperable obstacle in this attempt.

"We need the substance which I am trying to describe, far more urgently than we can say," he wrote. "It was the commander's idea, and my own, that it would be a fatal waste of time to allow the conversation to move to other topics, which I can well understand must interest you greatly. Had we learned where it might be found, there would have been no objection to answering any questions you might ask, while we were obtaining it; but we cannot remain here very long, in any case. You must have noticed—indeed your words have shown that you have noticed—how uncomfortable we are on this planet. Nearly half of us, now, are disabled from fractured limbs and strained tendons, fighting your terrible gravity; we live at all only through the use of a drug, and too much of that will eventually prove as dangerous as the condition it is meant to counteract."

"Is your vessel disabled, then?" asked Kirk.

"No, there is no mechanical trouble, and its power is drawn from the matter around it in space. We could travel indefinitely. However, before we dare return to a region where our enemies may locate us, we need a large store of—the material we seek."

"Have you no friends in that neighborhood, to whom you could have fled, instead of making such a long voyage to this solar system?"

"The voyage was not long—perhaps four hundred of your days. Our ship is powerful, and we used full acceleration until your sun showed its nearness by increasing rapidly in brilliance. We would have risked—did risk, since we had no idea of the distance—a much longer flight, to get away from that system. We had a ruler, but the captain decided we would do better on our own, and now there is no armed vessel within the orbit of the outermost planet that would not fire on us at sight."

"It would seem that you lack

ammunition, then, and possibly weapons." Kirk proceeded to make clear the difference in meaning between the words, using his rifle as an example.

"Weapons we have; it is the ammunition we lack," affirmed Talker. "I see how your rifle works; ours are similar, throwing a projectile by means of explosives. We have already manufactured the explosives from organic materials we found here; but the element we use in our projectiles is lacking."

"It would, I suppose, be a metal, such as that from which my bullets, or possibly the gun, are made," decided Kirk. "I know where these substances may be found, but you have not yet convinced me that my people can trust you with them. Why, if you are an outlaw in your own system as you claim, do you wish to return at all? You could not, so far as I can see, hope for security there, even with weapons at your disposal."

"I do not understand your question," was the reply. "Where else would we go? And what do you mean by 'security'? Our lot would be better than before, for we would not have to render up the greater portion of what we obtain to our ruler—we can keep it ourselves. There are many uninhabited portions of our world where we can make a base and live in ease."

"Something tells me that your way of life is different from ours," remarked Kirk dryly. "What is the metal you seek?" He wanted to know this for the sake of the knowledge; he had as yet no intention of helping the mothmen to obtain the substance. He wished that Talker's pencil could convey some idea of what the herald was really thinking. Writing, by one who barely knows a language, is not an extraordinarily efficient method of conveying emotions. "If you will show me one of your weapons, it may help," the man added as an afterthought.

Talker, naturally, had suspicions of his own arising from this suggestion. Unlike Boss, however, he was not blinded by them; and remembering that he had already divulged probably the most important characteristic of the weapons—the fact that they were projectile-throwers—he answered after a moment, "Come, then, and see."

It was characteristic of the herald that he tendered the invitation without consulting Boss, or even mentioning to Kirk the objections that the commander would probably raise. He had a contempt, born of long experience, for the captain's resolution, and it never occurred to Talker to doubt his own ability to override any objections. His confidence was justified. If Boss had possessed a heart, instead of a system of valves and muscle rings along the full length of his arterial and venous systems, he would probably have had heart failure when Talker coolly announced his intention of displaying the ship's armament to the Earthling; he was still sputtering half-formed thought waves as he followed the pair toward the air lock. Talker had merely explained the reason for his action, and acted; Boss would never have admitted, even to himself, that he considered Talker's opinion superior to his own, but he invariably accepted it as though it were. He was firmly convinced that his own genius was responsible for their successes to date, and Talker saw no reason to disillusion him.

Kirk learned little from the ship's guns, though the sighting apparatus would have given an artilleryman hours of ecstasy. The weapons themselves were simply ordinary-looking small-caliber, smooth-bore cannon, but with extremely ingenious mountings which permitted them to be loaded, aimed, and fired without losing air from the ship. The turret rooms were divided by bulkheads into two parts, one containing the gun and auxiliary mechanisms, and the other, to Kirk's surprise, piled high with metal cylinders that could be nothing but projectiles. He picked up one of these, and found it to be open at one end, with an empty hollow taking up most of its interior. Talker, who had made explanations from time to time, began to write again.

"We need material to manufacture the filling of that projectile," were his words. "Empty, it is useless for any purpose whatsoever."

"And when it is full—" asked Kirk.

"The shell penetrates the walls of a ship, leaving only a small hole which is promptly sealed by the material between the inner and outer hulls. The projectile is ruptured by a small explosive charge, and its contents evaporate, releasing an odorless gas which takes care of the crew. The ship can then be towed to a planet and looted without opposition and without danger—if you can reach a habitable world unseen."

"Why can you not use an explosive charge which will open a large hole in the hull, and do your looting in space?" asked the man.

"Air extends only a short distance outward from each world," explained Talker, his respect for the Earthman's knowledge dropping about fifty points, "so it is impossible to leave a ship or change ships while in space. An explosive shell, also, would probably destroy much of the interior, since the hull of a ship is far stronger than the inner partitions, and we want what is inside as nearly intact as possible."

Kirk waited rather impatiently for the herald to finish scrawling this message, and snapped, "Of course, I know about the airlessness of space; who doesn't? But have you no protective garment that will permit you to carry air and move about more

or less freely, outside a ship?"

"Many attempts have been made to devise such a suit," was the answer, "but as yet there is nothing which can be trusted to permit all our limbs to move freely, carry air to our breathing orifices, and possess air-tight joints and fastenings. I can see that there might be very little difficulty in designing such a garment for your simply constructed body, but Nature built us with too many appendages."

Kirk said nothing as he half-crawled down the low corridor to the air lock, but he did a lot of thinking. He was reasonably sure that most of his cerebral operations were indecipherable to the alien, though it was chiefly mental laziness which kept him from making any particular effort to couch his thoughts in nonvisual terms—such an effort would have been a distinct bar to constructive thinking, in any case. The herald's story, while strange from Kirk's Earthly point of view, was certainly not impossible; the conditions of life he had described had, in large measure, existed on Earth at various times, as the Earthling well knew. Kirk had gained considerable appreciation of Talker's rather cynical character, and had been somewhat amused at the unconscious egotism displayed by the herald.

The Sun was low in the west when the group emerged from the air lock, and a stiff northeast wind made its presence felt at the top of the bank, out of the shelter of the hull. Kirk looked at the sky and forest for a few minutes, and then turned to Talker.

"I will return to my camp now, and eat. You have given all the help you can, I guess. I will try to solve the problem tonight. I can make no promise of success, and, even if I do discover what your chemical is, there is the possibility that I will still fear to trust you with it. Your people are peculiar, to me; I don't pretend to understand half of your customs or ideas of propriety, and my first consideration must be the safety of my own kind.

"Whatever happens, I cannot remain much longer in the territory. You may not be acquainted with the seasonal changes of this planet, but you must have noticed the drop in temperature that has been evident at night the last week or two. We are located almost upon the Arctic Circle"—Kirk pictured mentally just what he meant—"and I could not live very far into the winter with my outfit. I should have returned to my own country several weeks ago."

"I cannot control your actions, even if I wished to do so," answered Talker. "I can but hope for the best—an unusual situation, all around, for me."

Kirk grinned at the herald's wry humor, turned, and strode away in the direction of his camp—he had not moved it closer to the ship, because of the better water supply at its original location. As he walked, the grin melted quickly from his features, to be replaced by the blank expression which, for him, indicated thought. He had no idea of what he should do; as he had told the herald, the man's first consideration was his own kind, but he wanted to believe and trust in the alien, whom he had come to like.

It was evident that Talker had not exaggerated the seriousness of his own position. Kirk had seen members of the crew moving painfully about their duties on board the ship, and had seen one of them collapse as the horny exoskeleton of his absurdly thin legs gave way under a body weighing more than three times what it should have. On the other hand, a crew of Earthmen under such conditions would have left long since, weapons or no weapons. Kirk found himself unable to decide whether the stubbornness of these creatures was an admirable trait, or an indication of less worthy natures. It occurred to him, fleetingly, that their idea of a "worthy" trait probably differed widely from his own.

Possibly, if the man decided to refuse aid to the strangers, he could quiet his conscience by comparing them to children refusing to come in out of the rain until mother promised them some candy—but a scientist, working overtime in his laboratory, could be described by the same simile, and Kirk knew it. No, the need was surely real enough to them.

And why should they want to attack mankind? Earth was useless to them, as a dwelling place; if, as they claimed, their own king were against them, only fools would make such an attempt, however armed. And Kirk was not impressed with the gas guns of the aliens—they were, even he could realize, worth absolutely nothing except in the confined space of an ether ship. On the other hand, Talker might have stretched the truth beyond its yielding point; and the "king," whom he might still be serving, would not need excuses such as the possible utility of a world in order to attack it, unless he differed greatly from Earthly rulers. The chance to extend his dominions would be motive enough.

Well, let that go for a minute. Kirk had arrived at his camp, and prepared a light meal. He ate slowly, still thinking, and washed the few utensils in the same fashion. The Sun had long been gone, and he sought his blankets with the intention of sleeping on the problem.

Sleep refused to come. He would absolutely refuse to consider one angle, and another promptly rose to torment him. What was the gas the aliens used? Kirk was not sure whether or not he regretted his ignorance of chemistry. The train of thought led by imperceptible, but perfectly natural, steps to

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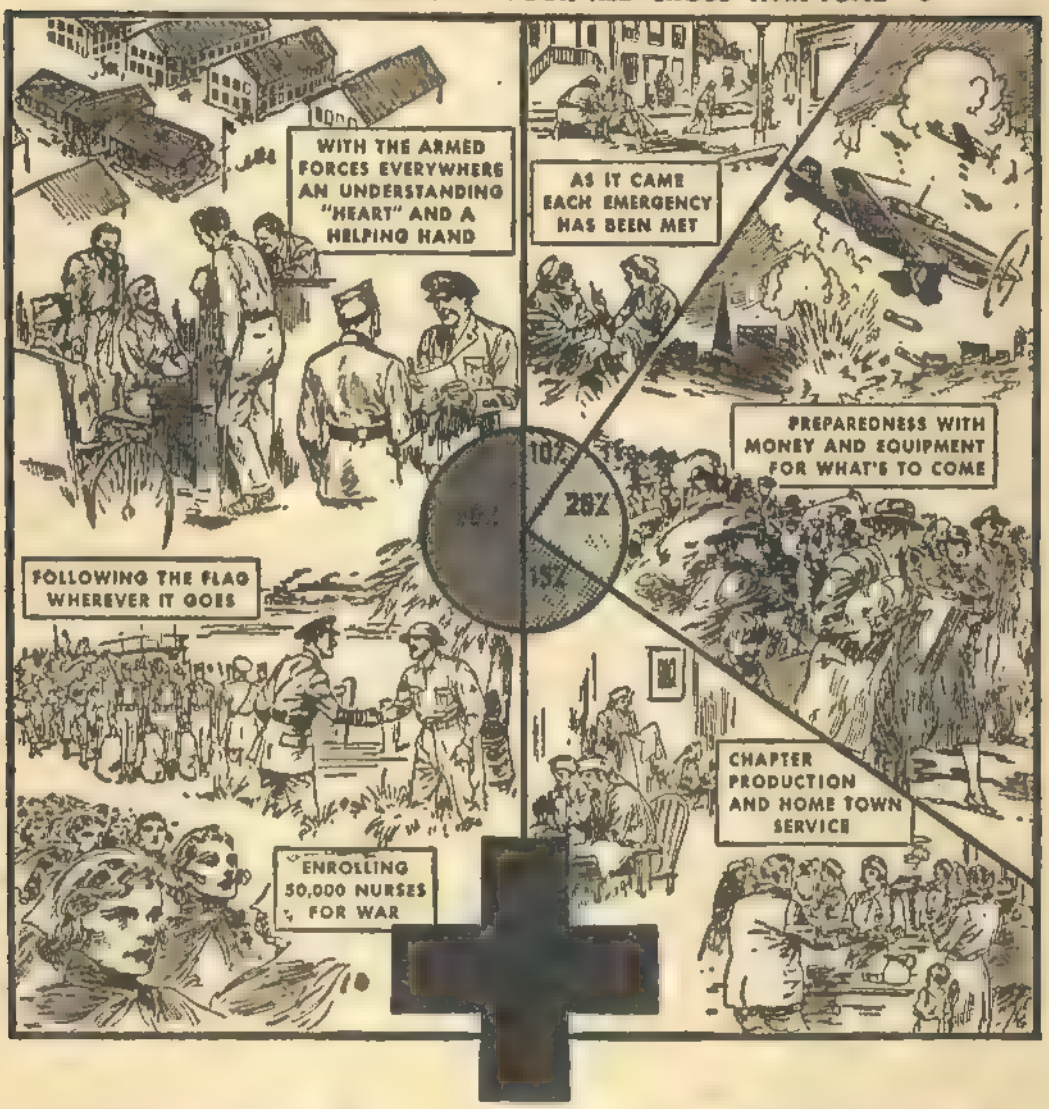

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the idea of insect poisons, his own original job in the territory, and the stock of copper sulphate and arsenate of lead which was stored at the river mouth port, for use the following spring. The idea left his mind as quickly as it had entered; for such materials did not, so far as Kirk knew, form any kind of gas. The job recalled his other occupation, which was still that of acquiring an education. The imminent opening of college presented itself as an additional reason for immediate departure; it was doubtful even now whether he could return to the States in time for registration—unless, he thought with a flicker of amusement, the aliens performed the necessary transportation. And so the trail of thought led itself in a circle, and he was once again considering the matter of the requirements of those on the spaceship.

And then another thought struck him. Let it be granted that the herald had adhered strictly to the truth at all times. He might, then, be a likable individual; he might be a shepherd trying to save the lives of his flock; he might be an officer worthy of respect for his ability and devotion to duty—no matter what he might be in his character, the simple and undeniable fact remained that, by his own admission of past activities and by his declaration of the uses to which he intended to put the weapons he hoped to acquire, he was neither more nor less than a pirate. He had stated plainly that Boss had revolted against the authority of his original ruler; he had tacitly admitted that he himself had concurred in the expression of independence; and he had used the term "outlaw" in describing the ship and its crew.

If Earth were to have any dealings with the herald's people, they would normally be with the law-abiding section of society. Kirk had no moral right to give assistance to that crew, no matter what his personal feelings might be. For a while, the Earthman pondered the matter, seeking flaws in the argument—seeking them solely because of the friendship he had commenced to feel for Talker, for any sort of decision would be a boon to his tortured mind.

But the fact stood; and eventually Kirk ceased attempting to argue it away, and accepted the simple idea that aiding the strangers would be, legally and morally, an offense against justice. Owing to the natural contrariness of human nature, he now found himself wishing he could help the alien with whom he had conversed so long; but the attainment of a decision had eased the tension in his mind, and at long last the man succeeded in falling asleep. He might have slept even more peacefully had he known a single fact—one of which not even Talker and Boss had dreamed.

Their interstellar voyage had consumed, not four hundred days, but more nearly forty years. The greater part of the flight had been made at a speed near that of light; hours of ship's time had been days outside. A similar period was certain to elapse on the return; and the ruler who had been defied would certainly have been succeeded by another. Talker and Boss could easily have passed themselves off as returning members of a legitimate interstellar expedition; even had they failed to do so, it is unlikely that they would have been punished for defying a ruler whose place their judge, as likely as not, would have inherited either by private assassination or conquest in war.

Unfortunately, Talker's race had no inkling of relativity, as their science was of the type which develops better guns and faster ships, without bothering too much with theory; and Kirk's only acquaintance with the concept had been made through the pages of a classic novel on time travel—the only such work he had ever read, and one which had emphasized the fourth dimension rather than velocity-mass ratios.

When Kirk awoke, therefore, it was with a distinctly uncomfortable feeling connected with the day's probable events. He rose, shivering in the biting cold of early morning, washed and ate, and broke camp. Whatever happened, he intended to head south that day, and he carefully made tent, blankets, and the other gear into a single large pack. This he cached near the camp site; then he picked up his rifle and took the trail over the hill into the next valley. He was fairly sure that the aliens could not harm him, except by landing their vessel on top of him, since they were without weapons and far inferior to him in physical strength.

But why, he suddenly thought, should there be any trouble? He need not refuse to help; it was simple truth that he had not been able to solve the problem—he still had no idea of the identity of the substance they desired. He could keep to himself his opinion of their occupation. Kirk was sure that the words describing that opinion had not been used in any of his conversation with Talker, and the herald must by this time he accustomed to receiving untranslatable waves from the Earthman's mind.

Thus determined, Kirk now emerged from the forest to the bank of the arroyo where the interstellar flier lay. As usual at this time of day, none of the crew was visible; also as usual, Kirk attracted attention to the fact of his presence by sending a stone clattering against the outer hull.

Talker, in spite of the ever-mounting fatigue that was threatening the lives of his party as much as any other single trouble, had also spent a portion of the night in thought. He had

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seen, more and more clearly in the last few days, that the chances of Kirk's learning the name of the poison were microscopic. A practical chemist, given a sample of the substance, could have identified it without difficulty; but without even a milligram sample on board, it seemed doubtful whether anyone could tell what was needed. The natives of this planet had, and used, poison gases; Kirk had told him that much. In their case, however, it was necessary in general to use them outdoors, and special characteristics of density and effectiveness were thus required. Talker knew that his gas was about twice as dense as the air of this world, under the same conditions of temperature and pressure; but he had no idea of the extent of its toxic qualities on terrestrial life.

The only chance, it seemed, if Kirk failed in his task, was to have him direct the voyagers to a place where someone skilled in chemistry, or warfare, or both, might be found. The herald had learned to communicate; the rest should not be difficult.

So it came about that Talker answered the bell-like clang on the hull with his mind set to expect the worst, and prepared to do something about it. He noticed at once that the human being was carrying his rifle, which he had not done since the first day, and the alien partially interpreted the reason for the act. He flew to the bank, and squatted in front of Kirk, antennae alertly spread. The Earthling, his mind made up, wasted no time.

"I have not solved the problem," he stated flatly.

"I am not surprised," wrote Talker, "nor am I angered. There was no need to bring the weapon—you cannot be blamed for failure at a task where one better trained than you could probably have done no more. It would be childishly stupid to hold animosity against you, in spite of our disappointment.

"But you can still help us. There must be, somewhere on this planet, individuals who are trained in such matters. You have mentioned your own need of getting out of this region before the onset of winter. We could easily transport you to your own place, and you in return can direct us to such a person as I have described. Are you willing?"

The herald's attitude at his failure had taken Kirk completely by surprise, and had added much to his opinion of the creature. The new suggestion found him unprepared, for his intended refusal seemed now even more unpleasant than before. Some inner guardian made him say simply, "I have left my equipment at the camp," and then he turned and strode, as rapidly as he dared, into the forest and away from the danger of betraying the thoughts whirling about in his mind.

A mile from the ship, Kirk stopped and tried to settle the recent happenings into his picture of the alien's personality. He had felt friendship of a sort for Talker, even after deciding he was a pirate and unworthy of such feeling; the attitude the herald had shown, in the face of what must have been a bitter disappointment, had strengthened Kirk's respect. Refusing to help was going more and more against the grain.

He tried to argue down his feelings. It was evident, from Talker's conversation, that the human-admired characteristics of altruism and sympathy were foreign to his make-up. He was perfectly selfish, and Kirk had no doubt that he would have seized any chance of saving his own neck, whether or not that chance also included the necks of his fellows. He looked on those others with tolerance, since they made life easier for him, but there was certainly no trace of fellowship in his feelings toward them. Kirk had repeatedly sensed the amusement in Talker's mind as he spoke of Boss and others of the crew, and was reminded of the interested contempt with which he himself had sometimes watched a child building sand castles at the seashore.

No, Talker was not an ideal character from a human point of view; but Kirk still felt attracted to him. Could he go back and tell the alien that it was useless to ask him for further aid? The man shrank from the thought; and yet what else could he do? Nothing. Slowly the human being finished the walk to his former camp site, shouldered the heavy pack, and turned back toward the ship. He walked sturdily, but the morning sunlight filtered through the leaves onto a face that looked far older than Kirk's twenty years would demand.

Talker was still waiting on the bank, both his great yellow eyes fixed upon the opening of the trail. He saw Kirk coming with his burden, and at once turned and flew to the air lock, disappearing within. Kirk saw him go, and called; the herald's head and antennae reappeared at the portal. The man dropped his pack to the ground, and stood motionless and silent, looking at the mothman and trying to find words in which to express the thing he had to make clear. He couldn't do it.

The thoughts were enough. Talker spread his wings and, concealing the frightful effort the act cost him, returned to the place where Kirk was standing. He still carried the writing materials, and, as the Earthling commenced to realize the extent to which he had been analyzed, he began writing.

"What is it that we have done to offend your customs?" asked the herald. "What possible interest can you have in those of my kind whom you have never seen, of whom you would never have heard except for me?"

Kirk tried to explain his attitude on the subject of piracy,

but failed signally. To the alien, raiding and looting were the natural means of making a living; his ideas of right and wrong simply did not match those of human civilization, any more than could be expected. It was Talker who finally decided that further effort in that direction was useless.

"When I first discovered you," he said, "it took some time for me to realize that the waves you radiated represented a pattern of intelligence. Your behavior eventually showed the truth, and with much effort I learned to interpret, to a certain extent, those thought waves. I fear that we are up against the same problem here. Just as it took me some time to comprehend that my thoughts were not the only possible kind, I am just beginning to understand that my behavior pattern is not the only possible one. With time, perhaps I may understand yours; I must, if to do so lies within the powers of intelligence. Therefore, I invite you to come with us, anyway, to the southern regions from which you say you have come. On the way, you will tell me more about your people, as I have told you of mine. Perhaps, with that background, I shall begin to appreciate your point of view and find a means of persuading you to help us. In any case, the knowledge will be of great interest for its own sake.

"Until I do have some understanding of your reasons for refusal, I shall not repeat our request; nor shall I inform the commander of what has occurred. The less he knows, the better for both of us, as well as himself. He could never appreciate what I am now trying to do, and he has no understanding of how a mind can seek pure knowledge without some immediate use for it—curiosity and imagination are unknown to him.

"Come, then; we will travel southward slowly, and converse as we fly. Some time at least will be saved; and we do not dare spend more than a few more days on this planet. We would not have enough of the crew left to man the engines—there are few enough of us now who remain able."

Kirk accepted, though never thereafter could he account for his reasons for doing so. Unconsciously, he wanted to give the creature a chance to justify itself; more and more the idea was winning ground that a being so generally reasonable and so utterly imperturbable in the face of telling disappointment could not be a criminal on any code. Such a belief, of course, is unreasonable and unjustifiable even when considered with respect to a single culture. Applied by a member of one civilization to a creature of another, such an emotional attitude is sheer lunacy. Logic alone stands a chance, and even that is likely to be badly crippled for lack of data.

Earthman and alien entered the air lock, and closed both doors—for nearly the last time on Earth, the herald hoped. Talker relaxed for a moment in the corridor, fervently vowing never again to spread his wings on a world where he couldn't fly without stimulants; then he crawled forward and up the ramp to the control room, Kirk following.

They found themselves alone in the control chamber, for it was still early morning. Talker sounded the signal intended to let Boss know he was wanted, and the oddly assorted pair waited in silence. Several repetitions of the call were necessary before Boss finally appeared from below. His attitude was even more domineering than usual, partly because he had just been awakened by the signal, and partly because he never missed an opportunity to try to impress the native with his importance; he never fully appreciated the fact that the human being could either "hear" his speech nor interpret his bodily attitude.

Talker told him to get the ship into the air, and cruise slowly toward the equator of the

planet until ocean was reached. Boss promptly began asking questions about the state of progress in locating the object of their search; and the herald replied that at the moment no progress was being made because the individual who should be working was talking instead. That silenced the captain, and he moved to the control board to call the engineers to their stations. Talker took his place at the commander's side, ready to transmit more detailed instructions if and when necessary. The signal board was a sufficiently versatile affair to transmit the relatively simple commands involved in raising the ship, however; as a matter of fact, the actual take-off, as would be expected, was handled from the control room, and orders were given merely to start the proper generators below.

Kirk laid his pack on the floor beside the captain and sat on it, thus bringing his head down to within about two feet of the other's. The glass ports, larger than any others in the ship, permitted him to see in all directions forward, while a periscope, which he quickly noticed, gave a partial view backward, leaving the lower rear the vessel's only blind spot. The periscope eyepiece was made to accommodate the huge optics of the ship's owners, and transmitted a decidedly distorted image to Kirk's eyes, as he found by experiment. The field of view could not be shifted, and its lower half was occupied by the hull. The man turned his attention to the great port which gave a clear view of what lay below and in front.

He settled himself more solidly as the ground slid smoothly away from him. There was no take-off run; the vessel rose straight for two thousand feet, turned the streamlined bow southward, and followed its nose. Boss relaxed at his post as soon as they were on course, and merely kept his eyes on a row of dials supposed to indicate the behavior of the generators. An engineer was watching a duplicate set below, and it made little difference whether or not Boss stuck to his job—though he would not have admitted that fact to Kirk had he been able to speak to him.

The human being and the herald watched and commented upon the terrain below, as it drifted sternward. Talker drew attention to the deserted appearance of the forest, and compared it to the similar vast, uninhabited regions of his own planet. This, as intended, drew from Kirk a description of the more densely populated countries, of the different peoples who inhabited them, and the various relationships existing between them. On this last point he was a fair lecturer, for he had spent a good deal of time on sociology. The herald kept him talking, asking questions whenever the man seemed to be running down, and in general doing everything which was likely to result in the production of any information that might be of use.

Their pace was only moderately rapid. The sound of the ship's passage through the air could not have been heard on the ground, and was inaudible through the double hulls; whatever power drove and supported them was efficient enough to be soundless, as well.

They came in sight of the sea and a small settlement at almost the same instant. The town was not large, but possessed several docks and a fair-sized fleet of fishing boats. Kirk recognized it—it was the town where he had landed upon his arrival at the beginning of the summer, and where he had recently turned in his report of the season's progress. It was now late afternoon, and a glance at his watch and a moment's calculation informed Kirk that the ship could not have been traveling more than thirty miles an hour, for they had left the base of his operations only slightly after noon. Five hours in the low control chamber had left the man rather cramped; he flung a query at Talker, and was informed that the main corridor was probably the only room on the ship spacious enough to permit him to stretch, even lying down. Kirk's memory of the gun rooms suggested that the herald was right, so he sent his pack sliding down the ramp, followed it, detached a blanket and stretched out on the corridor floor, to the no small astonishment of a pair of soldiers who emerged from their rooms at that moment. He had brought no food, but did not feel particularly hungry. After a few minutes, he propped himself up with the pack as a pillow, and stared off down the hallway. The door at the far end was now open, and faint sounds came from below. Kirk considered investigating, but thought better of it and relaxed on his blanket.

A very faint trembling of the floor roused him a few minutes later. He stood up—too suddenly, for his head impinged sharply on the metal ceiling—and turned toward the control-room ramp once more. Something appeared to be happening. He started up the incline, but did not reach the top, for as his head attained the level of the floor above he saw Talker starting down, and retreated before him.

Boss followed the herald into the main corridor, and Kirk walked behind the pair to the air lock. Evidently the ship had landed. The man brushed Talker's wing tip with a finger to get his attention, and asked, "What is the matter? Why have you come down so soon? I know of none around here who could give you help."

"Your words do not agree with your thoughts of a few moments ago," returned Talker, who still carried the paper and pencil. "I hoped, when I asked you aboard after your avowal of enmity to-

ward us, that your mind would betray some knowledge of value. It has done that; you are not accustomed to having your thoughts read, and have surprisingly little control over them. Had I not been delayed through having to learn your system of mental symbology, we would have had long ago the information we needed, without the necessity of asking your consent. When the settlement near which we are now landed came into view, your mind gave out word patterns of all sorts—the name of the place, which means nothing to us, the fact that the individual who directs your work resides therein, and—the fact that there is stored somewhere in that town a supply of chemical to be used for poisoning insects. Your master is an expert on such matters; he must be, to hold the position. It is possible that the chemical will prove to be what we require; if not, I have learned to read human minds from you, and I can pry the knowledge from the one who directs you."

"Then you asked me aboard solely in the hope of tricking me?" asked Kirk. "There was no friendship, as I had believed? No sincere attempt to understand my point of view, as you claimed?"

"It would indeed be interesting to understand your peculiar ways of thought," replied the herald, "but I have spent all too much time in satisfying idle curiosity; and I see no practical value to be derived from the understanding you mentioned. You are like the others on this ship—easily swayed by stereotyped patterns of thought; I can see no other possible reason for your refusal to aid us. I bear you no enmity, since I have almost achieved my goal in spite of you; but it would be truly idiotic to expect me to feel friendly toward you. None the less, it would be interesting to know—" the strangely shaped hand abruptly ceased writing, and its owner turned toward the air lock, where Boss was waiting impatiently.

That last, unfinished sentence did much to check the cold anger that was starting to rise in Kirk. In silence, he watched the air-lock doors swing open. Through a screen of tangled deadwood, a few houses were visible; but no people appeared to be interested in the ship. How Boss had been able to bring the vessel down unseen so near the town will forever remain unknown.

The two aliens flew over the brush, choosing a moment when no human beings were in sight, and concealed themselves behind bushes fairly close to the nearest houses. Kirk, sitting on the sill of the outer door, could imagine the herald's sensitive antennae picking up the thought waves of one after another of the unsuspecting townspeople. He would have trouble with some of them, thought Kirk with a grin, as he recalled the three-quarters Indian population of the place and the illiteracy of a large percentage of this group, but how would it be possible to prevent the alien's looting the minds of Faxon, the poison specialist, or old MacArthur, the storekeeper? Warning them would be easy enough, but useless; the more they tried not to think of what was wanted, the more certain most of them were to do so. If they tried to attack and drive away the aliens, the latter could simply retreat into the ship and study the attackers at will. It looked as though Talker would win after all; or—did it?

A thought struck the man, hazy and ill-defined at first. It had something to do with Indians and illiterates; something he couldn't quite place, dimly remembered from his psychology study—and then he had it. A grin spread over his face; he leaned back against his pack, and watched the herald as men, women and children, both white

and red, passed within a hundred yards of his hiding place. Once again Kirk pictured the mind-reading "danger"; but it was markedly different from the former picture. He tried to control his thoughts, to make the joke last as long as possible—he wasn't sure that the herald could read his mind at this range, but why take chances? He tried to think about the subject in French, since he had to think about it; the results were not exactly what he had intended, but the mental pictures were undoubtedly tangled enough to baffle any mind reader. And then the mothmen were winging their way back to the ship.

Kirk moved aside to let them enter, and watched as the pair settled to the air-lock floor. Talker made no attempt to write; he simply stood and looked at the Earthman with an expression of hopeless resignation in his very carriage that sent a stab of pity through Kirk's heart.

The man stared back for a few moments, and then began speaking softly.

"You know, now, I did not think of it until you had gone—but I should have, from what you told me; and you should long since have known from your own observations. When we first learned to communicate with each other, you told me that my thought-wave pattern was different from that of your race, which was natural enough, as you finally realized. You did not carry that reasoning, which told you it was natural, to its logical conclusion; nor did I. Your people all 'think' alike—so far as either of us is able to tell what thought is. The patterns you broadcast are mutually intelligible to members of your race, but not to me, because you have received those waves from others of your kind from earliest childhood, and I am a stranger. But my people do not communicate in that fashion; as you have learned, we have organs capable of impressing fine modulations on sound waves, and of detecting these modulations. The activity that occurs in our brains is never directly transmitted to other brains—it is first 'coded' and then broadcast.

"The waves you 'hear' arise from chemical activity in your nervous systems, activity that accompanies thought. They are—must be—controlled to a vast extent by the structure of the nerve pattern in your brains; a structure which is itself controlled during your growth by the impressed waves from outside, in conjunction with whatever strange process accompanies learning."

Kirk held out a hand to the herald.

"Look closely at the ends of my fingers. In the skin you will see a complex pattern of ridges and hollows. That pattern, stranger, is unique in me; every one of my people has a similar, but individual, pattern—no two have identical fingerprints. They form the most positive means of identification we possess, although there are more than two billion beings on this planet.

"And yet, friend, I think I am safe in saying that there are many times as many chances that two of us should bear identical fingerprints as there be chances that two human brains should be exactly alike, nerve for nerve. From birth, each brain is isolated, can be reached only through the means of communication natural to us; there is no reason that all should develop alike.

"On that assumption, the tiny currents that pass from nerve to nerve and give rise to the waves that you can sense cannot possibly be the same for any two of us; and so no two sets of 'thought waves' could be identical. You learned some of my pattern, and thought that you had the key to communicate with all my kind; but I tell you sincerely that you will have to learn afresh the 'thought language' of

every new human being with whom you wish to converse. You have just discovered that for yourself.

"These cerebral radiations are not entirely unknown to us. Certain devices, in the nature of extremely sensitive electric detectors, have been able to measure and record them; but the only pattern shared by any significant number of human minds is that characterizing sleep—mental inactivity. The instant the subject wakes, or even has a dream, the 'alpha pattern' breaks up into a seemingly disorganized jumble.

"We also know a little concerning direct thought exchange. Some of our scientists have experimented for many years, in the attempt to determine its nature and cause. Many people—not the scientists—assume that it is due to radiations like those recorded by the devices I mentioned; they imagine the possibility of perfecting those machines and using them for communication. They have heard of the experiments in telepathy, but have not bothered to investigate their details.

"The experimenters themselves have pointed out that the phenomena of telepathy and clairvoyance, which seem to be closely connected, are quite inconsistent with the known laws of radiation, such as the inverse square law. I don't remember all the details, and, anyway, I'm not a physicist; but the best known of those scientists claims that our present science of physics does not contain the explanation of the experimental results.

"Whatever the true state of affairs may be, I am sure you will never get anything from any human mind but my own. I hate to tantalize you, but if you had not made this attempt to deceive me, my emotions would probably have overcome my common sense sufficiently to force me to help you; even now I am tempted to do so, because I can't help feeling that your mind contains the roots of curiosity, with which I sympathize—I wouldn't have pursued my studies this far, otherwise. But I could never trust you, now. My intelligence, such as it is, gave one estimate of your character, and my feelings gave another; and unfortunately for you, your actions showed the intelligence to be at least partially correct. Your character probably isn't your fault, but I can do nothing about that. My advice to you is to take on supplies and get away from here while some of you are still alive; the fact that you found an inhabited planetary system at the first try suggests that others may not be too hard to locate. I wish you luck, so far as good luck for you doesn't mean bad for us."

Allen Kirk turned, swung the pack to his shoulder, and walked away from the spaceship. He was acutely aware, as he went, of the two pairs of yellow eyes gazing after him; but he didn't dare to look back.

THE END.

★ ★

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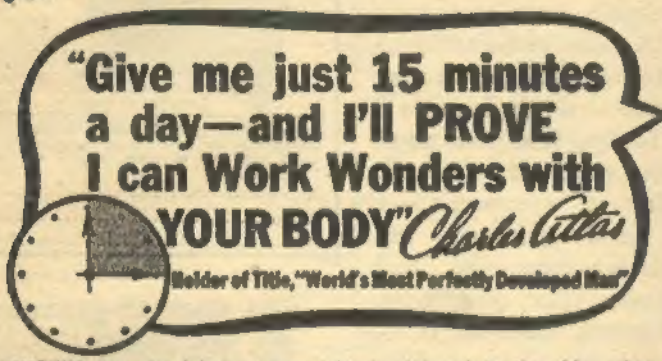

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